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ABSTRACT

Programed training filmstrips from Project LIFE (Language Instruction to Facilitate Education) were used with 114 hearing impaired children and 15 normal hearing language impaired children (4- to 13-years old) to assess the effects of auditory supplementation and a token reinforcement program on language learning and to investigate retention and relearning after a 3 to 6 month interval. Ss were assigned to either a visual or audiovisual training modality and subdivided further into a token or non-token reinforcement condition. Evaluation measures included periodic administration of receptive and expressive generalization tests to measure transfer of learning. Among conclusions were that primary students benefited from auditory supplementation of the Project LIFE filmstrips, that Ss using Project LIFE showed no additional benefit from an extrinsic token reinforcement system, and that Ss retained the receptive language skills acquired during Project LIFE instruction over an interval of at least 6 months. (Appended are receptive and expressive generalization tests used in the study.) (LS)

LANGUAGE LEARNING OF CHILDREN AS A FUNCTION OF SENSORY MODE OF PRESENTATION AND REINFORCEMENT PROCEDURE

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INTRODUCTION

Many surveys of academic achievement have found that congenitally deaf and severely hard of hearing children rarely surpass a fourth grade reading level (Goetzinger and Rousey, 1959; Wrightstone, Aranow, and Moskowitz, 1963; Furth, 1966). In response to this serious truncation of receptive language skill Project LIFE initiated a training program in 1963 with the long term objective "...to foster the growth of receptive language abilities in hearing impaired children so that their reading achievement surpasses the presently acknowledged 'fourth grade plateau' at the secondary school level." (Pfau, 1973, pg. 3).

During the initial stages of the project, language curriculum materials were developed with consultation by educators of the deaf (Wooden and Willard, 1965; Wooden, 1966). At that time Project LIFE employed a teaching machine consisting of a filmstrip projector, a tape player, and a consolette. The consolette contained a rear-view screen for projecting the training filmstrips, coded buttons for multiple choice responses, a special phone for presenting auditory stimuli, and a window where written responses could be made. Programmed language materials included words, sentences, and short paragraphs emphasizing structural meaning derived from function words, word order, derivatives and inflections.

Many modifications of Project LIFE were introduced during succeeding years of development. In the current version of the system (Pfau, 1969; 1970 a, b) both the auditory component and the written response mode are absent. Basic elements of the system are a filmstrip projector, a Student Response

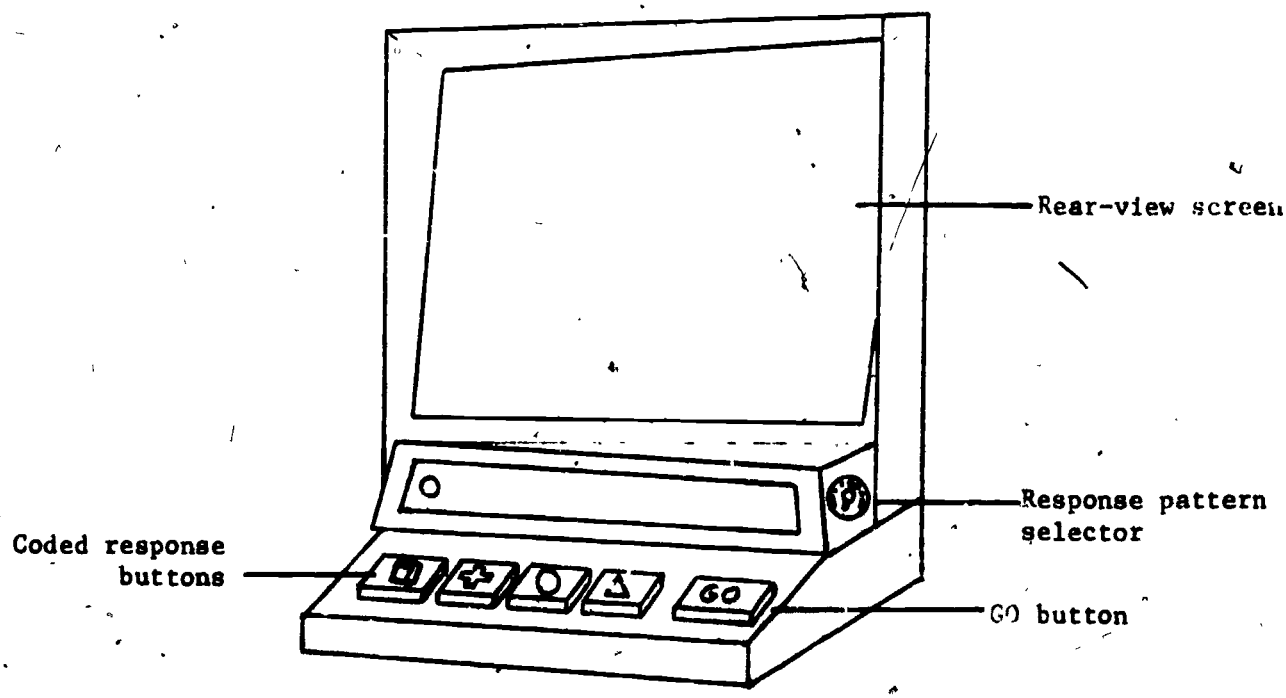
Program Master (shown in Figure 1), and programmed training filmstrips. Filmstrip frames with multiple choice response selections are projected onto a rear-view screen mounted on the Program Master. The student presses one of four coded response buttons to indicate his answer. If the answer is correct a green GO button lights. When the GO button is pressed the projector automatically advances to the next frame. The student must continue to respond until the correct choice is made before advance is possible.

The first objective of our research was to determine the effects of introducing supplemental auditory cues simultaneously with the existing visual cues provided by Project LIFE. Under the experimental treatment a tape recording of the visual message was synchronized with the filmstrip advance.

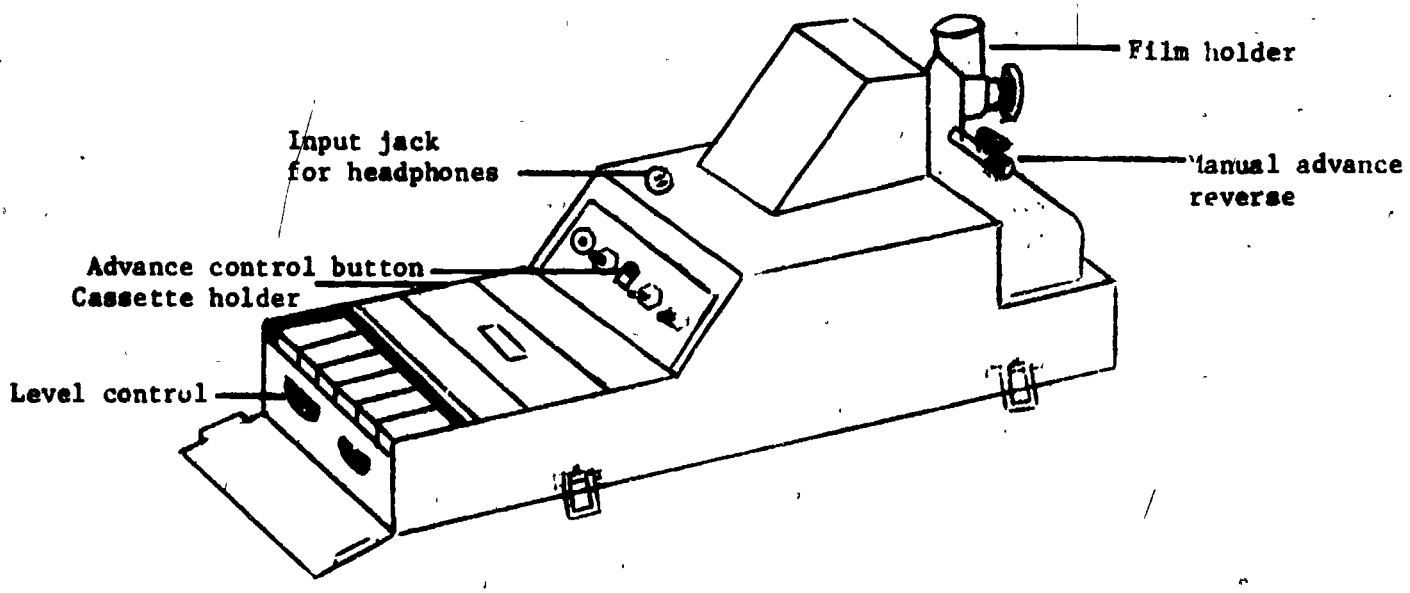
Empirical evidence concerning the effects of bisensory auditory-visual channeling of information is very sketchy and the scattered reports that do exist are difficult to relate directly to language acquisition. Sanders (1971) and Erber (1971) both found that speech discrimination of hearing impaired children improved when amplified speech supplemented visual lipreading cues. However lipreading and reading are clearly different tasks. The Sanders and Erber experiments called for identification of known language units, whereas in Project LIFE instruction students learn previously unknown language structures.

To illustrate further the importance of the task variable we may cite work by Gaeth (1967). His extensive research on paired-associate learning by hearing impaired children found bisensory audiovisual presentation of stimuli was not superior to unisensory stimulation. Learning curves for the bisensory condition either coincided with the better of the two unisensory curves or fell between the two. In this instance the task involved rote learning of arbitrarily paired items, relying heavily on memory processes. Language learning on the other hand calls for the acquisition of syntax, semantics, and morphology, a

Figure 1. Project LIFE Student Response Program Master and automatic cassette/filmstrip projector.



Student Response Program Master



Automatic cassette/filmstrip projector

process that relies to some extent on memory, but more importantly on rule learning.

A second objective of the present research was to investigate the effects of token reinforcement on rate and extent of language learning. Project LIFE has as a built in reinforcing device, the GO button, which lights when a correct response occurs and allows the filmstrip to advance when the button is pressed. Thus the training program depends upon an intrinsic reinforcing event. In the present investigation keys were used as tokens that later could be exchanged for prizes. The number of keys earned was contingent upon the number of correct responses accumulated during each language training session.

In a review of research on classroom use of token reinforcement programs O'Leary and Drabman (1970) found evidence for improvement in academic behavior when reinforcement contingencies were in effect. Furthermore, token reinforcement has been found more effective than teacher praise or information feedback in a number of instances. For example, Smith, Brethower, and Cabot (1969) reported that study behavior and correct responding in a programmed language arts curriculum improved under two reinforcement procedures: (1) dispensing pennies at the end of each session contingent upon appropriate behavior and number of correct responses, and (2) tallying the number of points earned each day and plotting the daily results. Verbal praise by the teacher was not an effective reinforcing stimulus in this situation.

A third purpose of the present investigation was to test generalization of learning to a novel receptive language task and to a written language task. Receptive generalization tests required subjects to label correctly a stimulus or to complete grammatical sentences by piecing together sentence segments. The expressive generalization task employed a modified "cloze" procedure where subjects filled in blanks or wrote answers to questions in response to stimulus pictures.

The final phase of this research examined the retention of learned material and compared original and relearning error rates for a group of subjects at the elementary level. The retention interval ranged from three to six months.

In summary, the purposes of the investigation were as follows:

(1) to determine the effects of supplemental auditory cues on Project LIFE receptive language learning;

(2) to investigate the influence of a token reinforcement program on receptive language learning;

(3) to assess the generalization of receptive language learning via Project LIFE to a novel receptive language task and to written expressive language;

(4) to determine the amount of retention of learned language material; and

(5) to compare the error responses of original learning and relearning.

PILOT STUDY

Purpose

The purpose of the pilot study was to evaluate experimental procedures and stimulus materials prior to conducting the main experiment. In particular the investigators were interested in determining: (1) the amount of time required to complete a filmstrip; (2) procedures for establishing token reinforcements; and (3) the appropriateness of the receptive and expressive generalization tests.

Method

Subjects

Subjects consisted of 11 children aged seven to nine from Woodcreek Elementary School in Lansing and seven children aged 11 to 13 from the Michigan School for the Deaf (MSD) in Flint. All subjects were in the Special Education program for hearing impaired children.

Equipment

At each test site four complete Project LIFE training units were established. Each unit consisted of a Standard Model 333 RC or 666 RC filmstrip projector, a Project LIFE Program Master, and associated parts. All four Program Masters at each site were connected to an Esterline-Angus 20-channel chart recorder, switch type Model S620-X. The chart recorder provided a permanent record of error responses made on each frame of the training filmstrips.

The Program Master had eight preset correct response patterns that correspond to the sequences of correct responses on the training filmstrips. The appropriate response pattern for each filmstrip could be selected by dialing the Response Code Selector (Figure 1).

When one of the coded response buttons was pressed this response was compared electronically with the correct answer. If the comparison was positive the green "GO button" lights up and advances the film when depressed. If the comparison was negative an Error Counter on the back of the Program Master was incremented and the film could not be advanced.

Materials

Filmstrips. Project LIFE has developed several types of training filmstrips, including a Perceptual Training Series and a Language Training Series. In the pilot study different combinations of films from the Perceptual Training

Series, Set 1, were employed to introduce subjects to the operation of the Program Master. Perceptual training films required the subject either to match pictures, letters, or words, or to choose one stimulus that differed from others in a set.

In the language training films two types of frames predominated: (1) picture stimuli with several printed response alternatives; and (2) printed stimuli with picture alternatives. The films were organized into Sets that focus on small groups of related language structures. For example, Set 1 introduced five nouns and the present progressive forms of four verbs. The number of films in a Set ranged from four to nine, and in each Set the final film was a review test. Sets 1 - 8, comprising Level I and Sets 9 - 16, comprising Level II served as training material in this investigation. Target language constructions for each film are outlined in Table 1.

Receptive Generalization Tests (RGT's). The generalization tests were developed to evaluate performance on a novel receptive language task incorporating the language structures introduced during training. RGT's were devised, each reviewing a series of 2 to 4 filmstrips; most Sets had two associated RGT's, one to be administered after completing part of the Set and another to be given just prior to the Set test filmstrip. The format used was multiple choice with correction. The number of items per test increased from 2 to 3 in the early tests to 8-10 on later tests. The items were sequenced so that progress through the test developed a story line. Appendix A contains the scripts of the RGT's, including the filmstrips whose content each covers. Test materials consisted of magnetized pictures, words, phrases, and sentences to be placed on a portable metal chalkboard. At the beginning of the test the subject's response alternatives (correct choice plus foils) were placed before him, each item's

Project LIFE: PROGRAMMED WORDS
(Listed by Set)

Set 1
- 1A: boy, girl, baby, man, woman
- 1B: is running, is sleeping
- 1C: is walking, is sitting
- 1D: (none)
- 1E: boys, girls, are walking, are running
- 1F: babies, are sitting, are sleeping
- 1G: (test)

Set 2
- 2A: dog(s), cat(s)
- 2B: a, some
- 2C: bird(s), is/are flying
- 2D: big, little
- 2E: (noun-verb agreement)
- 2F: and
- 2G: (test)

Set 3
- 3A: is/are eating, is/are drinking
- 3B: apple(s), cookie(s), meat
- 3C: water, milk
- 3D: ate, drank
- 3E: (test)

Set 4
- 4A: has, have, flower(s)
- 4B: one, two, three, car(s), ball
- 4C: doll(s), balloon(s), wagon(s), airplane(s)
- 4D: red, green, blue, yellow
- 4E: black, white
- 4F: (use of "have" with compound subjects)
- 4G: (subject-verb agreement)
- 4H: (test)

Set 5
- 5A: is/are playing with, played with
- 5B: ("have" vs. "play with")
- 5C: who, what
- 5D: (test)

Set 6
- 6A: Joe, Bob, Mary, Ann
- 6B: eyes, nose, hair, ears, mouth, blond, brown
- 6C: is, are
- 6D: book(s), kite(s), boat(s)
- 6E: she, he, it
- 6F: (pronouns as objects of verbs)
- 6G: (test)

Set 7
- 7A: pant(s), shirt(s), coat(s)
- 7B: shoe(s), cap(s), dress(-es)
- 7C: Bob's, Mary's, Ann's; boy's, girl's
- 7D: (test)

Set 8
- 8A: bed, table, chair, on, under, is/are jumping
- 8B: car, basket, box, in, tree
- 8C: house, bedroom, bathroom, room, kitchen, other rooms
- 8D: sofa, lamp, stove, sink, bathtub
- 8E: (test)

Set 9
- 9A: to, is/are riding, school, bus, bike
- 9B: schoolroom, paper, his, teacher, pencil, her, desk
- 9C: hit, is/are hitting, ran, playground
- 9D: is/are pushing, is/are falling, pushed, fell
- 9E: hurt, head, foot/feet, knee, hand, leg, arm
- 9F: is/are reading, is crying, is/are writing, cried, home
- 9G: (test)

Table 1. Programmed words presented in each Set of Language Training Films. (Continued on page 9)

Set 10
- 10A: they, their, its
- 10B: is/are talking, had
- 10C: I, you, am
- 10D: we, happy, sad
- 10E: (test)

Set 11
- 11A: my, your, clean, dirty, face
- 11B: wash, will wash, is/am washing, dry, dried, is/am drying, will dry
- 11C: our, sister, brother, mother, father
- 11D: whose
- 11E: doing, What ... doing?
- 11F: (test)

Set 12
- 12A: where
- 12B: is/are going, church, am going, store
- 12C: stop, street, stopped, go, light, policeman, wait
- 12D: sandbox, swing, jump rope, jumped, is/are playing, is/are swinging
- 12E: is/are coming, come (imp.), seesaw, jungle gym
- 12F: slide, down, is/are sliding, ladder, up, is/are climbing
- 12G: (test)

Set 13
- 13A: want(s), some, does not, pie, cake
- 13B: hungry, thirsty, juice, hamburger, hot dog, want/do not want
- 13C: yes, no, thank you, please
- 13D: cereal, eggs, carrots, potatoes, soup, lunch time, breakfast time
- 13E: likes, candy, oranges, bananas, ice cream, dinner time
- 13F: bread, butter, corn, full, may
- 13G: (test)

Set 14
- 14A: plate, knife, pan, bowl, fork, saucer, glass, spoon, dishes, cup, them
- 14B: cabinet, is cooking, is putting, refrigerator, put (imp.)
- 14C: is/are helping, broke, break (imp.), her, him
- 14D: me, us, help (imp.), napkin
- 14E: (test)

Set 15
- 15A: TV, you, will watch, is/are watching, watched, watch (imp.)
- 15B: is ...?, are ...?, What do ... have?
- 15C: dresser, sheet, blanket, pillow, will make a bed, are making a bed, made a bed
- 15D: towel, soap, sink, toilet, will take a bath/shower, took a bath/shower, is taking a bath/shower
- 15E: (verbal review of rooms of house)
- 15F: (test)

Set 16
- 16A: is/are wearing, has/have on, shirt, will wear, blouse, tie
- 16B: is/are putting on, will put on, boots, socks
- 16C: is/are taking off, take off, scarf, sweater, took off, gloves
- 16D: pink, pretty, purple, orange, color (What color ... ?)
- 16E: hang up, hung up, pajamas, is hanging up, slippers, robe
- 16F: old, new
- 16G: (test)

alternatives in a separate group. The experimenter placed the stimulus phrase or picture for the first item on the chalkboard, then pointed to the appropriate response group. If the subject selected the correct response, the experimenter so indicated and proceeded to the next item. If the response was incorrect, the experimenter removed it and asked the subject to make another selection.

Expressive Generalization Tests (EGT's). Expressive tests were designed to determine whether receptive training would carry over to written language performance. Tests consisted of: (1) 8 1/2 x 11 pictures that represented language structures presented during training, and (2) accompanying fill-in-the-blank sentences. Each picture was a scene portraying everyday activities such as school, at the farm, getting ready for bed, and so forth.

The initial EGT, designed to acquaint subjects with the task, provided multiple choice responses for all but the last test item. In the seven later tests only the first item had multiple choice alternatives. In contrast to the RGT's, the content of expressive tests was not confined to immediately preceding language filmstrips. Required responses ranged over both Levels of training. (Copies of the tests can be found in Appendix B.)

Token reinforcements. Silver keys purchased from a local novelty company served as tokens. When subjects accumulated the required number of tokens they selected an inexpensive toy from a treasure chest.

Procedure

Subjects at each test site were divided into a token and a non-token subgroup. Subjects in the non-token group received training for approximately two weeks before the token group started. When the token group began training, non-token subjects were switched to the token procedure.

In order to orient subjects to the teaching machines, filmstrips from the

Perceptual Training Series, Set 1, were administered. Three or four filmstrips from the series were selected for each subject so that different combinations could be tested. Daily training sessions were held throughout the pilot study except when school holidays or special activities intervened.

Since somewhat different training procedures were in effect for the younger subjects at Woodcreek School and the older subjects at Michigan School for the Deaf they will be described separately.

Woodcreek School. Each subject began the Language Training Series with Film 1A in Set 1. The criterion for 'passing' a filmstrip was based on the number of errorless frames; a score of 70 percent or more allowed the subject to proceed to the next filmstrip. If the score fell below 70 percent the film was repeated during the next session with help from the experimenter. Review test films at the end of each Set were presented only once, however.

Michigan School for the Deaf. The older 11 to 13 year old subjects at MSD were administered the review tests at the end of each Set until they failed the 70 percent criterion. The subjects then started on a film-by-film basis. An effort was made to obtain some consistency in the starting level for film-by-film progression so that group error rates could be compared for the same training material. If only one subject in a group failed a review test the frame responses were analyzed to determine the language structure associated with the errors. Then the film that focused on this language structure was administered with prompting by the experimenter. The subject then proceeded to the next review test.

Token reinforcement program. At the beginning of each training session subjects were shown the number of frames on their filmstrip for that session. A ratio of one silver key for ten errorless frames was used. Immediately after

the film was completed the experimenter told the subject how many frames were correct and the subject was given the appropriate number of keys to store on a large key ring. Ten silver keys could be exchanged for a toy from the treasure chest.

Receptive Generalization Tests. For the younger subjects RGT's were administered following completion of the filmstrips listed below. Subjects

Films Completed	1A	1B,C	1D,E,F	2A,B,C	2D,E,F
RGT Number	1	2	3	4	5

Table 2. Schedule of Receptive Generalization Tests for younger subjects.

were given the RGT's at the beginning of the next training session. Older subjects who progressed through the review tests received RGT's periodically so that some of the more advanced tests could be evaluated. RGT numbers 7, 11, 13, 14, 17, and 21 were administered during the pilot period.

A multiple choice format with a correction procedure was employed. If a subject selected an incorrect response alternative it was removed and the subject was instructed to make another choice.

Expressive Generalization Tests. The EGT's were scheduled several times during pilot training. Each subject first was given the introductory test, In the Store, with multiple choice fill-ins provided for all but the last test item (see Appendix B). Subjects later completed two or three additional EGT's.

Results

Perceptual Training Series

Films from Set 1 of the Perceptual Training Series introduced subjects

to the operation of the Program Master. Each subject completed films P1, P2, and two or more of the remaining seven films in the Set. All subjects in the pilot groups were able to perform successfully on films P1 and P2. A typical frame in these films presented a stimulus picture or configuration and required the subject to select an identical picture or configuration from a response set with from one to four alternatives. Among the later films, P3 to P9, film P6 was found to provide an appropriate transition to language training. In this film letters and words serve as stimuli; subjects select the matching letter or word from four alternatives.

Language Training Series

Woodcreek Elementary School. Of the 11 subjects who began language training with Set 1, three passed all of the films according to the 70 percent criterion. The remaining eight subjects had to repeat at least one of the training films with prompting by the experimenter. During the repeat sessions when prompting was available most of the subjects succeeded in reducing their errors to a passing level. One subject, however, failed several consecutive filmstrips even when help was offered. Rather than force the subject to continue in a failing situation, the following rule was formulated. If a subject fails two successive filmstrips with prompting, any remaining training films will be skipped; the subject will receive the review test and then proceed to the initial training film from the next Set. If this film is failed the subject will return to an earlier training level.

For each subject the number of frame errors was tabulated for each filmstrip. Only data obtained with no prompting were included. Since the number of frames varied from film to film, error scores were converted to proportions so that performance could be compared across filmstrips. The mean proportion

errors for each filmstrip in Set 1 and Set 2 are shown in Figure 2. There was a trend of increasing errors as training progressed within each Set, from 1A - 1F and 2A - 2F. Higher error rates were attributed to greater difficulty in the content of the training films and an increased pool of language structure that was sampled as the Sets progressed.

Michigan School for the Deaf. Mean proportion error rates for the seven subjects are plotted as a function of the review tests in Figure 3. Performance generally was very high. On four of the review tests, however, several subjects failed to meet the 70 percent criterion; three subjects failed review films 3T, 10T, 11T, and two subjects failed 9T. Recalling that Sets 1 - 8 make up Level I and Sets 9 - 16 make up Level II, there appears to be an increase in difficulty in the second Level.

When subjects failed a review test they were given a training film focused on their errors. This procedure succeeded in reducing errors and enabled subjects to continue to the next review test.

Token reinforcement. Experience with subjects in the pilot study led to a procedure for teaching the subjects the token system. The subject was first shown the number of frames on the filmstrip. When the film was completed the experimenter wrote down the subject's total correct frames, e.g. 41. When tokens were introduced the experimenter used the correct total to indicate the number of keys earned. For example 41 was then written as ④1 -- 4 keys.

In the token program when subjects accumulated 10 keys they were allowed to select a toy from the treasure chest. We found that younger subjects were reluctant to turn back their silver keys in exchange for a prize. To eliminate this problem a number of keys were painted red. Each time the subject collected 10 keys they were exchanged for one red key and a prize.

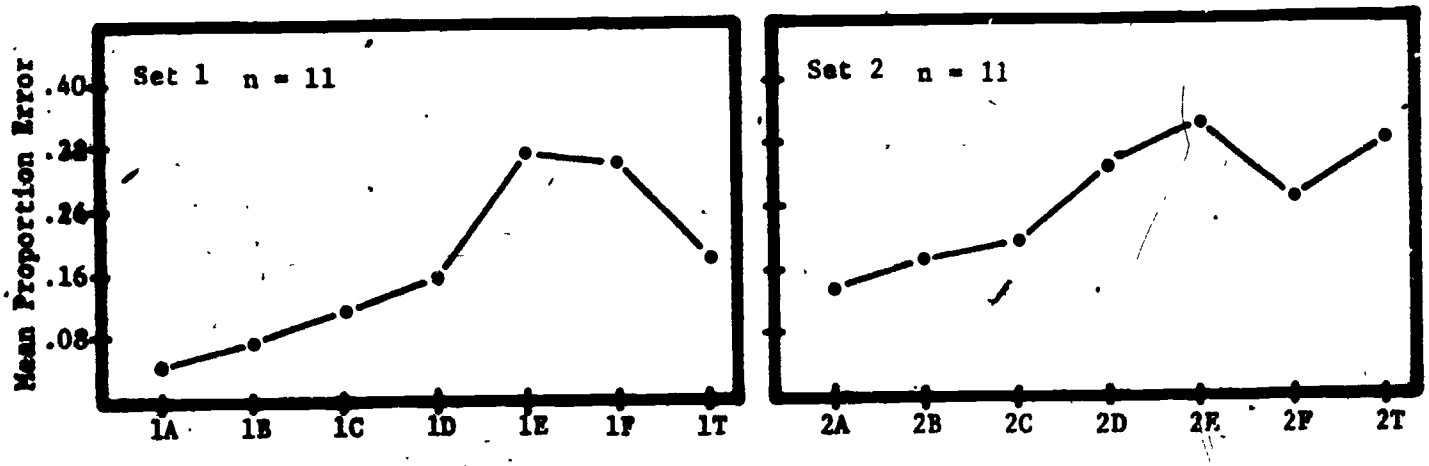


Figure 2. Mean proportion errors for younger pilot subjects on Set 1 and Set 2.

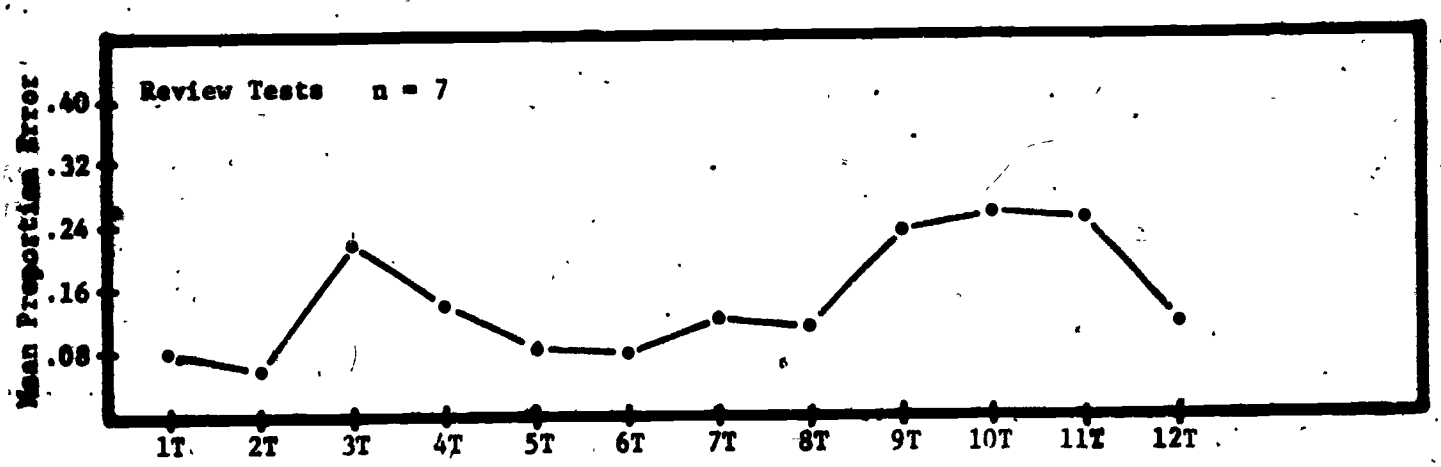


Figure 3. Mean proportion errors for older pilot subjects on review tests 1T through 12T.

Older subjects posed a different problem. The inexpensive toys in the treasure chest had a limited appeal for this age group. In fact several subjects rejected a prize. It was decided that more advanced subjects should be required to earn 20 keys and then receive a more appropriate array of backup reinforcements such as comics, kites and cosmetics.

Receptive Generalization Tests. Subjects at Woodcreek School completed the first five RGT's during the pilot program. Overall subjects achieved an 82 percent level of correct responding. On the six more advanced RGT's subjects at MSD averaged 88 percent correct responding. The tests were considered satisfactory for use in the main experiment.

Expressive Generalization Tests. Samples of these tests were administered both at Woodcreek School and at MSD. After the introductory test with multiple choice responses was completed, later tests provided a multiple choice set only for the first item. Subjects at Woodcreek School were unable to perform the task of filling in the blanks under these conditions. Subjects at MSD usually attempted to complete the test, but there were many errors of grammar. When test items called for a noun phrase, correct responding reached 68 percent; for verb phrases correct responding was 37 percent.

Performance on the expressive tests was much poorer than on the receptive tests. It was decided to continue both generalization tests in the main experiment so that the relationship between the two types of performance could be studied further.

Summary of Decisions

1. Perceptual films P1, P2 and P6 will be used to introduce subjects to the Student Response Program Master.

2. Less advanced subjects will begin language training with Set 1, film 1A. If performance falls below 70 percent correct, the film will be repeated with help from the experimenter.
3. If two consecutive films are failed with help the subject will proceed directly to the review test and then to the first film of the next Set. If this film is failed the subject will return to an earlier training Set.
4. In order to promote a common starting level for older or more advanced subjects, the following rule will apply. If a review test is failed, the subject will complete a filmstrip that focuses on the language structure associated with the errors. The subject will then proceed to the next review test. When several subjects fail the same review test, all subjects will begin film-by-film progression at that point.
5. Less advanced subjects will earn 10 keys for each backup reinforcement. More advanced subjects will earn 20 keys.
6. Receptive Generalization Tests will be scheduled for all subjects during training. Expressive Generalization Tests will be administered weekly to the more advanced subjects.

MAIN EXPERIMENT

Purpose

The major objectives of the experiment were to determine the effects of supplementary auditory cues and a token reinforcement program on programmed language learning. Retention of learned material and rate of relearning were also evaluated.

Method

Subjects

A total of 114 hearing impaired children and 15 normal hearing language

impaired children participated in the Project LIFE language training program. In Table 3 the distribution of ages and hearing levels are summarized.

	Hearing Level				
Age	Profound	Severe	Moderate	Language Impaired	Total
4 - 6	24	6	4	14	48
7 - 9	32	11	9	1	53
10 - 13	10	8	10	0	28
Total	66	25	23	15	129

Table 3. Distribution of subjects according to age and hearing level.

Categories for hearing level were based on the better ear average threshold at 250 Hz, 500 Hz, and 1000 Hz. Criteria for the categories were: (1) Profound--$>$90 dB; (2) Severe--- 75 dB to 90 dB; (3) Moderate--$<$75 dB. Within the hearing impaired group subjects attended Averill School, Woodcreek School, and Walnut Street School in Lansing and the Michigan School for the Deaf in Flint. Language impaired subjects with normal hearing were selected from the client population at the Michigan State University Speech and Hearing Clinic.

Equipment

Four Project LIFE training units were established at each of the test sites. A training unit consisted of a filmstrip projector and a Student Response Program Master mounted with a rear view screen. Two units employed visual filmstrip projectors, Standard Model 333 RC or 666 RC, and two employed automatic cassette/filmstrip sound projectors, Standard Model 1002. The Model 1002 projectors accept cassette tapes that can be synchronized automatically with the filmstrip advance. An auxillary jack was used to transmit the recorded messages to the subject by earphones. Standard TDH-39 earphones housed in

MX41AR cushions were employed. All of the projectors were fitted with 1 1/2 in. lenses. Tapes were presented at 100 dB, or 90 dB if requested by subjects.

Each Program Master was connected to two channels of an Esterline-Angus 20-channel chart recorder, switch type Model S620-X. One channel marked correct responses; the second channel marked error responses. The Program Masters were modified so that multiple errors on the same response key could be recorded.

Materials

Programmed filmstrips. Films P1, P2, and P6 from Set 1 of the Project LIFE Perceptual Training Series introduced subjects to the operation of the Program Master. Programmed language training employed films in Level I, Sets 1 - 8 and Level II, Sets 9 - 16 from the Language Training Series.

Auditory tapes. For each language training filmstrip a script was prepared itemizing the auditory messages corresponding to each frame. On many frames the item presented a picture as a stimulus and a set of phrases or sentences as response alternatives. The auditory message would dictate the correct response. Therefore it was decided to record auditory cues only on alternate frames of this type. Separate analyses can be made then of error rates on frames with and without supplementary auditory information.

Two male speakers with standard American dialect recorded the auditory messages. Recording apparatus included a TC110A tape recorder and microphone, a Hewlett-Packard 4204A oscillator, and Memorex 30 audio cassettes. Calibration was accomplished and maintained by an electronics technician. Equipment for calibration included a B&K 2203 sound-level meter and B&K 4132 microphone used in conjunction with a B&K 4152 6-cc coupler. Three copies were made of each tape so that a complete set was available at each site.

Generalization tests. Receptive Generalization Tests consisted of sets

of pictures and related words, phrases, and sentences. Using a multiple choice format, subjects were required to construct grammatical sentences in response to picture stimuli, or to select a picture representing a printed stimulus. Expressive Generalization Tests employed a modified "cloze" procedure with written fill-in-the-blank test items. The content and method of construction of these tests were described in the Pilot Study. [Sample tests can be found in Appendices A and B.]

Auditory Post-Test. An Auditory Post-Test was developed and administered at the end of training. The test consisted of eight recorded sentences, listed in Table 4, similar to those introduced in the early programmed language filmstrips. The subject listened to each sentence at either 90 dB or 100 dB and selected one of three pictures from the response set.

Token reinforcement. Bogus silver keys served as tokens during training. Less advanced subjects selected backup reinforcements from a treasure chest containing miscellaneous novelties. Older more advanced subjects received inexpensive jewelry, cosmetics, comics, kites, and the like, in exchange for keys.

Procedure

Subjects were scheduled daily for half-hour training sessions in groups of two to four. One filmstrip was administered per session. Within each classroom subjects were assigned to either a Visual (V) or Audiovisual (A) modality. Subjects in these groups were further assigned to a Token (T) or Non-Token (NT) reinforcement condition. In an effort to establish relatively equivalent groups, audiometric data and academic records were examined and classroom teachers were consulted. When similar pairs of subjects were identified one member was assigned to the Audiovisual group and one to the

AUDITORY POST-TEST

The birds are sleeping.

____ birds sleeping

____ boy sitting

____ girl sitting

Some boys are running.

____ boys running

____ girl walking

____ woman sitting

The boy and the girl have books.

____ boy and girl w/book

____ girl sitting

____ man walking

A dog is sitting.

____ dog sitting

____ baby walking

____ girl running

Two girls are sitting.

____ girls sitting

____ boy running

____ babies sleeping

The boy is walking.

____ boy walking

____ baby sitting

____ man sitting

The baby is sleeping.

____ baby sleeping

____ girl standing

____ girls running

The woman is sitting.

____ woman sitting

____ boy running

____ girl walking

Table 4. Sentences presented in the Auditory Post-Test and pictorial response alternatives.

Visual group. Subjects in the Non-Token groups began training approximately two weeks earlier than Token subjects, making it possible for all subjects to be introduced to the token program at the same time.

The appropriate starting level for language training was estimated from the educational placement of the subjects. Those placed in lower primary classes started with Set 1 of the Project LIFE Language Training Series; upper primary subjects were administered review tests until several members of the group failed. Training then continued on a film by film basis. Table 5 gives the distribution of subjects in the four experimental groups. [Kindergarten subjects, excluded from the Table, will be discussed below.]

	Audiovisual Token	Audiovisual Non-Token	Visual Token	Visual Non-Token
Lower Primary	13	13	12	11
Upper Primary	13	10	9	13

Table 5. Assignment of subjects in upper and lower primary classes to experimental groups.

Subjects were introduced to the Program Masters by Perceptual Training films P1, P2, and P6 from the Introductory Unit, Set 1. Lower primary subjects then began film by film language training starting with Set 1, film 1A, of the Language Training Series. Upper primary subjects completed successive review tests from the Language Training Series. When several subjects failed a test all subjects in that group switched to a film by film progression.

At the beginning of each session subjects were shown the number of frames on their filmstrips, and then upon completion of the films, they were informed as to the number of frames they had completed without error. When tokens were introduced subjects received one key for each 10 errorless frames. Initially

the experimenter wrote the appropriate number of frames, e.g. 35, and then circled the digit in the ten's place, (3) 5--three keys. As training progressed, to check the subjects' understanding of this system, subjects were told the number of frames on which they produced no errors and asked if they knew how many keys they should receive.

The criterion for passing a filmstrip was 70 percent or more errorless frames. When a subject failed a film it was repeated during the following session with prompting by the experimenter. If a subject failed two consecutive films with help, the review test for that Set was administered, followed by the initial film of the next Set. If this was failed also, no further data were collected; the subject returned to an earlier training level.

Subjects on film by film progression received Receptive Generalization Tests according to the schedule in Table 6. More advanced subjects who progressed test by test were given RGT's every third day. The RGT's were administered at the beginning of the training session following completion of the listed groups of films.

Expressive Generalization Tests were administered once before language training began and weekly thereafter. Only upper primary subjects who started training with review tests participated in this aspect of the experiment. The EGT's also were administered at the beginning of training sessions.

At the end of the experiment each subject was given an Auditory Post-Test consisting of eight recorded sentences, each with three multiple-choice picture alternatives, as listed in Table 4.

There were some differences in procedure for kindergarten children who were at a pre-reading level. This group included the 15 language impaired normal hearing subjects and 20 hearing impaired subjects. The primary difference

FILMS COMPLETED	RGT NUMBER	FILMS COMPLETED	RGT NUMBER
1A	1	8A, B, C, D	15
1B, C	2	9A, B, C	16
1D, E, F	3	9D, E, F	17
2A, B, C	4	10A, B, C, D	18
2D, E, F	5	11A, B, C, D, E	19
3A, B	6	12A, B, C	20
3C, D	7	12D, E, F	21
4A	8	13A, B, C	22
4B, C	9	13D, E, F	23
4D, E, F, G	10	14A, B, C, D	24
5A, B, C	11	15A, B, C	25
6A, B, C	12	15D, E	26
6D, E, F	13	16A, B, C	27
7A, B, C	14	16D, E, F	28

Table 6. Schedule for administering Receptive Generalization Tests during the main experiment.

was the increased number of films from the Perceptual Series that were administered to provide a better transition to language training. The number of perceptual films given depended upon the subjects' readiness to advance, estimated by performance on films P1, P2, and P6. Also, subjects sometimes were administered only part of a film due to attentional and motivational factors.

Results

The primary method of analyzing the language training data was a comparison of average proportion errors made by the different experimental groups. A separate analysis was carried out for each Set of training films. Within each experimental subgroup the number of errors was recorded for frames of each filmstrip. Subgroup error scores were then converted to proportions to eliminate differences due to the varying number of frames from film to film. Table 7 illustrates these steps with hypothetical data for Set 1. Data were included for all subjects who passed the experimental criterion. However, only errors were included that were made during the first administration of a film without prompting. Additional analyses examined level of correct responding on receptive and expressive generalization tests.

The primary experimental variables were presence or absence of token reinforcement and sensory modality during training. Within the two sensory groups, Audiovisual and Visual, subjects also were categorized according to whether they passed or failed the Auditory Post-Test. On the basis of the binomial distribution, a score of six or more correct out of eight sentence discriminations was considered passing.

Token Reinforcement

The effects of token reinforcement were assessed by comparing the performance of subjects in the Token (T) and Non-Token (NT) groups during the first

Set 1 Subgroup: Visual-Token

Subject	Number of Frames Film	(46) 1A	(40) 1B	(50) 1C	(45) 1D	(56) 1E	(56) 1F	(52) 1T
1		2	6	10	10	15	20	12
2		0	2	3	6	10	9	7
3		4	2	8	8	15	16	8
4		0	0	4	6	9	11	5
	Sum of Errors	6	10	25	30	49	56	32
	Mean = Sum/N	1.5	2.5	6.25	7.50	12.25	14.00	8.00
Proportion = Mean/Number of frames		.03	.06	.12	.17	.22	.25	.15

Table 7. Analysis of hypothetical error data converted to mean proportion error scores.

Set 1 Subgroup: Visual-Token

ect	Number of Frames Film	(46) 1A	(40) 1B	(50) 1C	(45) 1D	(56) 1E	(56) 1F	(52) 1T
		2	6	10	10	15	20	12
		0	2	3	6	10	9	7
		4	2	8	8	15	16	8
		0	0	4	6	9	11	5
	Sum of Errors	6	10	25	30	49	56	32
	Mean = Sum/N	1.5	2.5	6.25	7.50	12.25	14.00	8.00
	Number of frames	.03	.06	.12	.17	.22	.25	.15

able 7. Analysis of hypothetical error data converted to mean proportion error scores.

two weeks of training before tokens were introduced. In this time period lower primary subjects completed Set 1 of the Language Series and a group of upper primary subjects progressed from review test 1T through test 8T. The mean proportion errors produced by these groups are shown in Figure 4. Error functions for Set 1 show that subjects reinforced with tokens had lower error rates than subjects not reinforced with tokens on all films except 1A where they were equal. However, a t-test comparing the mean proportion errors of subjects in the T group and NT group found $t = 1.29$, 31 df, a non-significant value at the .05 level. For subjects who progressed through the review tests there was essentially no difference in the performance of subjects with and without tokens. Therefore it must be conclude that the token program in the present experiment did not affect error rates during language learning.

Sensory Modality

Lower Primary Subjects. The effects of sensory modality on language learning were a function of the level at which subjects started training and the subjects' performance on the Auditory Post-Test. Comparisons between Audiovisual and Visual groups were made separately for subjects who passed and failed the Auditory Post-Test. Results of language training were then related to performance on Receptive Generalization Tests.

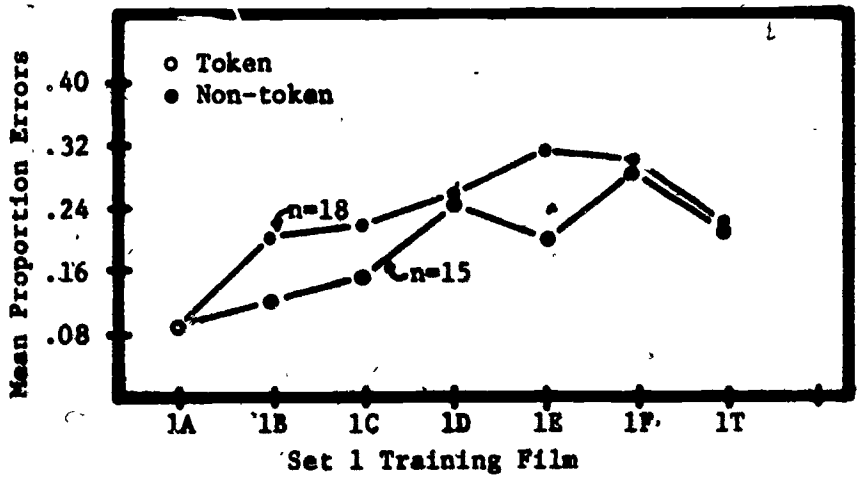
(Language training). In Figure 5 error functions for lower primary subjects who passed the Post-Test are on the left; functions for those who failed are on the right. Data in Sets 1, 2, and 3 represent essentially the same subjects, those in the lower primary classes who began training with film 1A. Exceptions are seven subjects who started training in Set 2 and a small group who terminated training after failing the experimental criterion. In Set 1 all

subjects are combined since only one subject in the Audiovisual group passed.

Under the Audiovisual condition subjects consistently had lower error rates in Set 1, and those who passed the Post-Test made fewer errors in Sets 2 and 3. For those who failed the Post-Test, performance was equivalent under the two sensory conditions in Sets 2 and 3. When the mean proportion errors of subjects were submitted to t-tests, the mean difference between the A and V groups in Set 1 was significant, $t = 2.23$, 31 df. The values for subjects who passed in Set 2 and Set 3 were $t = 1.84$, 8 df, and $t = 2.00$, 6df, respectively, approaching significance, but failing to meet the .05 probability level.

The finding that A and V groups who failed the Post-Test performed alike in Set 2 reinforced the view that auditory supplementation rather than differences in general ability produced the effect in Set 1. There were, however, some changes in the composition of subjects from Set 1 to Set 2 in Figure 5. Therefore a further analysis was carried out with data restricted to subjects who completed both Sets. These error functions, shown in Figure 6, exhibit the same relationship with lower mean error rates in Set 1 for Audiovisual subjects.

Although the small number of subjects who passed the Post-Test precludes any strong statement, it appears that auditory supplementation also may have continued to influence the performance of subjects who could discriminate sentences auditorily in Sets 2 and 3. As shown in Figure 5, on every film except 3T the Audiovisual groups made fewer errors than the corresponding Visual groups. An explanation for the small number of Visual subjects who passed the Post-Test lies in the imperfect correlation between audiometric data and sentence discrimination performance. Almost all Audiovisual subjects



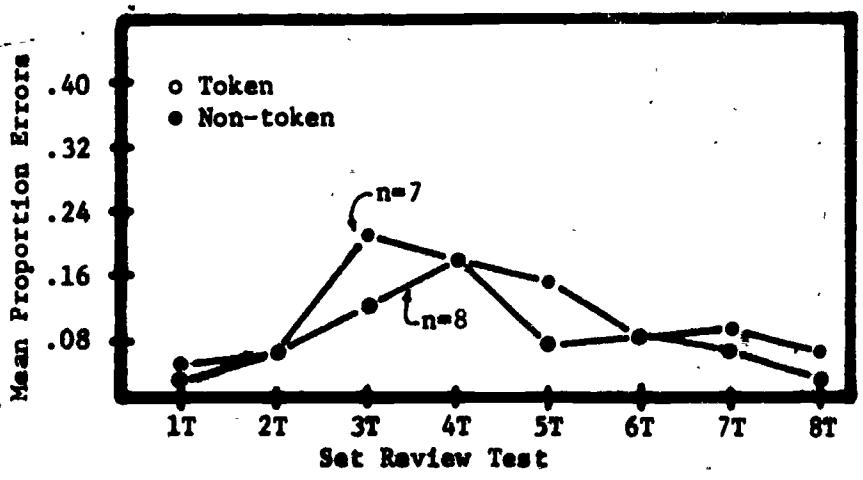


Figure 4. Mean proportion errors of subjects under the token and non-token conditions during the first two weeks of training.

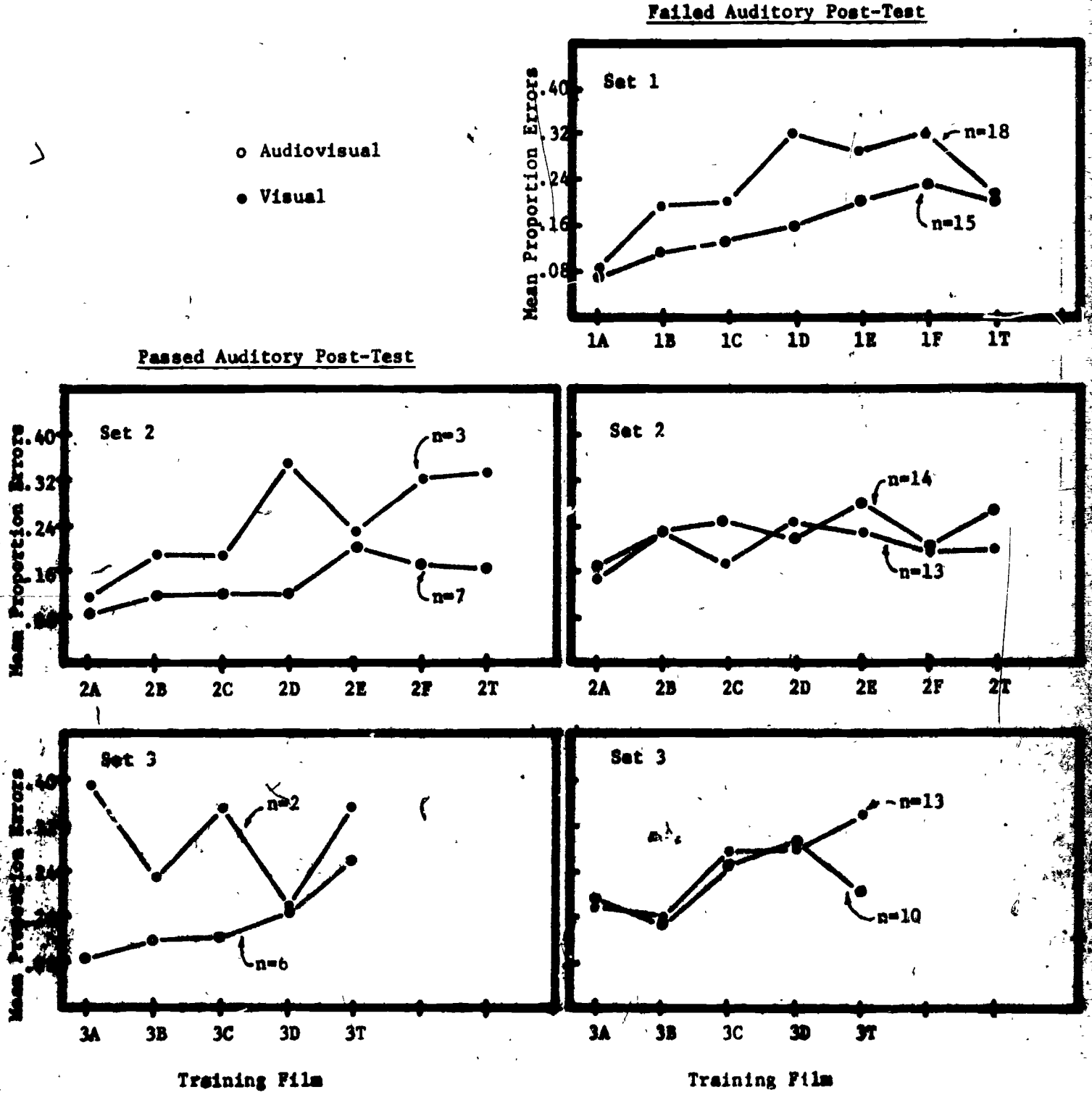


Figure 5. Comparisons of mean proportion errors under audiovisual and visual training for subjects who passed and failed the Auditory Post Test.

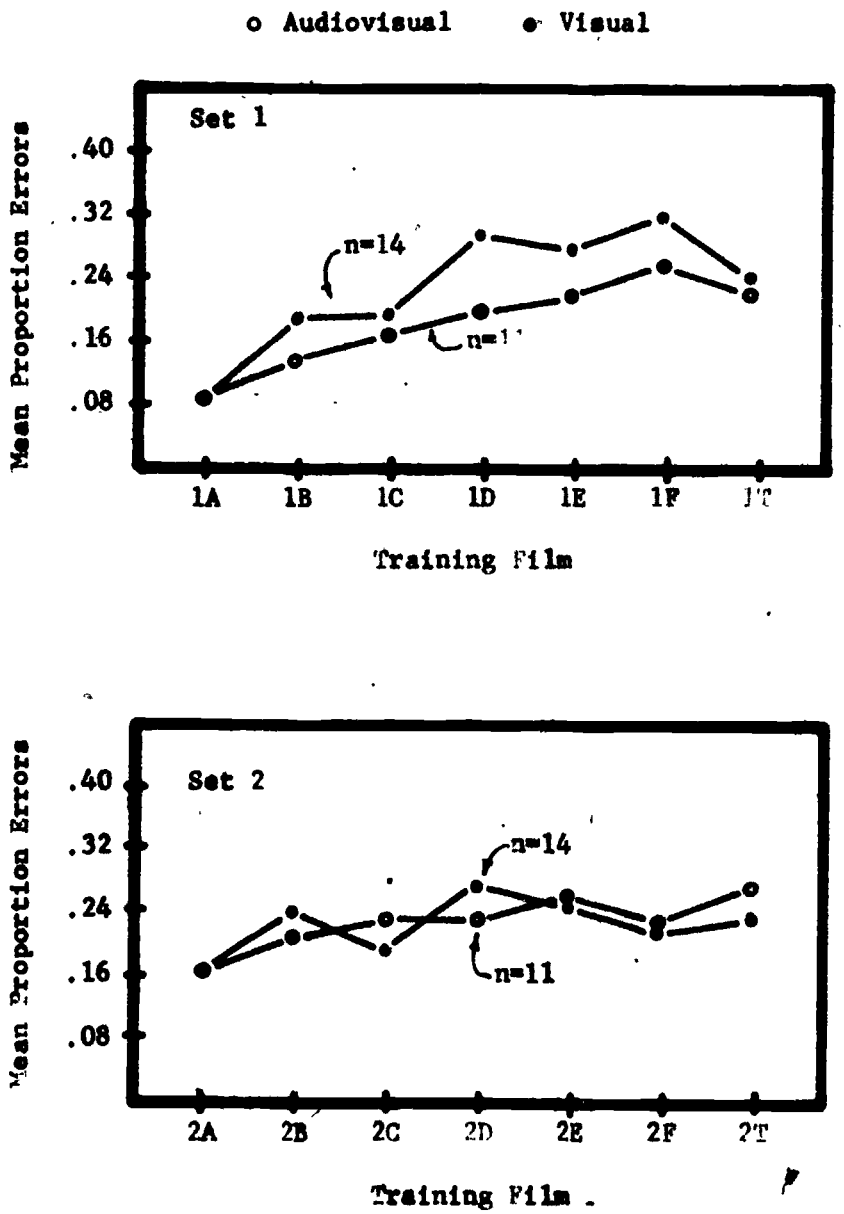


Figure 6. Mean proportion errors for subjects who completed both Set 1 and Set 2 under audiovisual and visual training conditions.

with pure tone averages between 75 dB - 90 dB passed the Post-Test while most of the Visual subjects in the same category failed.

In an effort to determine the nature of the effect of auditory input on language learning the error data were examined separately for frames with and without an auditory message. If the auditory message simply provided subjects with correct answers we would expect superior performance primarily on auditory frames. On the other hand, if the auditory cues facilitated learning of the language structures, performance should have been better on both auditory and visual frames. A comparison of A and V groups for Set 1 and A and V groups who passed for Sets 2 and 3 are shown in Figure 7. Superior performance on the part of the Audiovisual subjects is evident on both types of frames, supporting the hypothesis that auditory supplementation influenced their overall learning.

The previous discussion focused on the relative performance of the A and V treatment conditions. It was argued that the presence of auditory cues facilitated learning in Set 1 and continued to influence subjects with good auditory discrimination in Sets 2 and 3.

A further analysis within each sensory group compared performance of subjects who passed and subjects who failed the Auditory Post-Test. If both Audiovisual and Visual groups who passed the test achieved lower error rates than those who failed, the effect could be attributed to a superior language base associated with better auditory discrimination. However, if the effect appeared only in the Audiovisual group, then lower error rates would reflect the influence of auditory cues during training. In Figure 8 the mean proportion errors in Set 2 and Set 3 are plotted for Audiovisual and Visual conditions of training. Within the Audiovisual group differences were found favoring subjects

o Audiovisual
• Visual

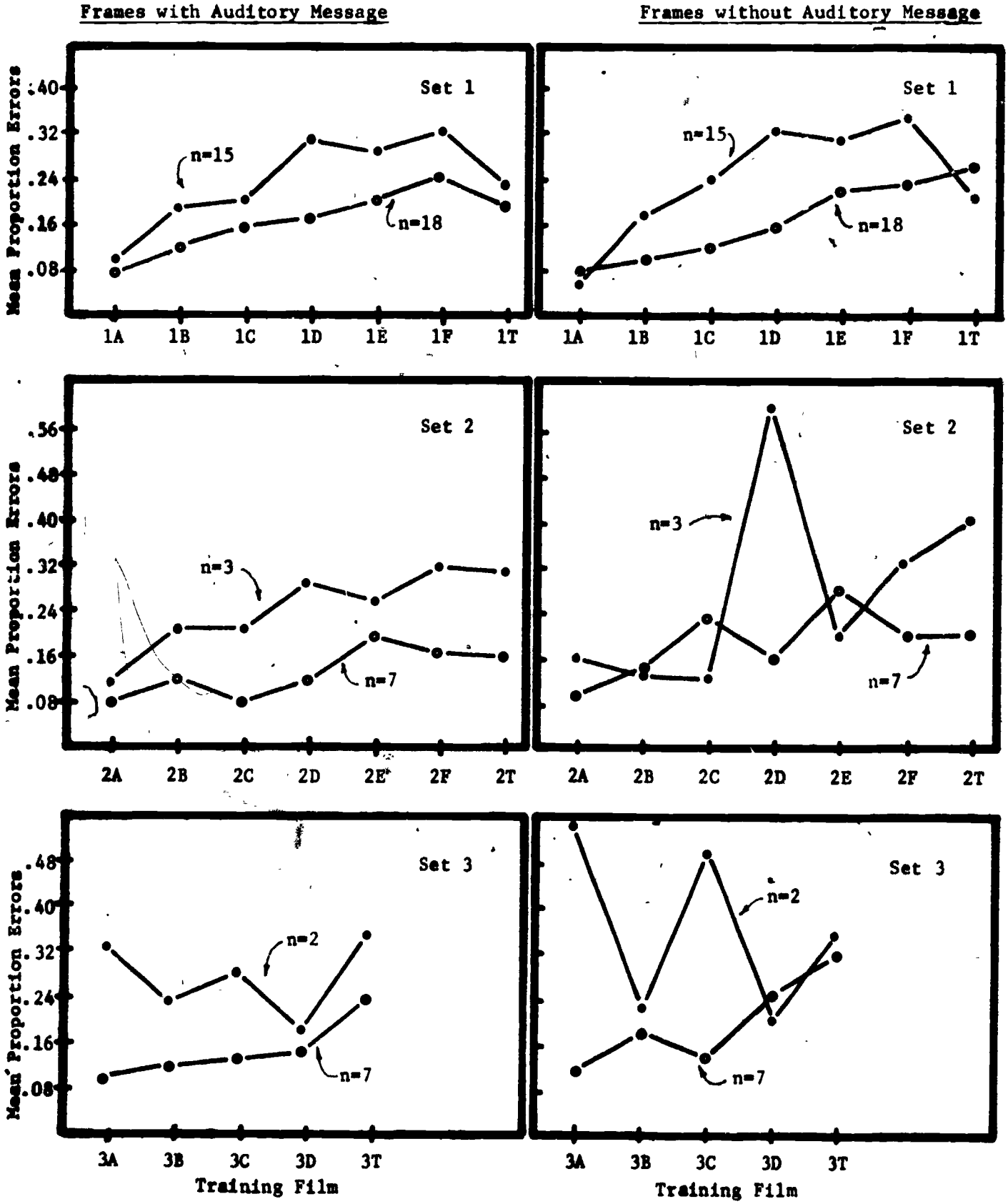


Figure 7. Comparisons of mean proportion errors of subjects under audiovisual and visual training for training frames with and without an auditory supplement.

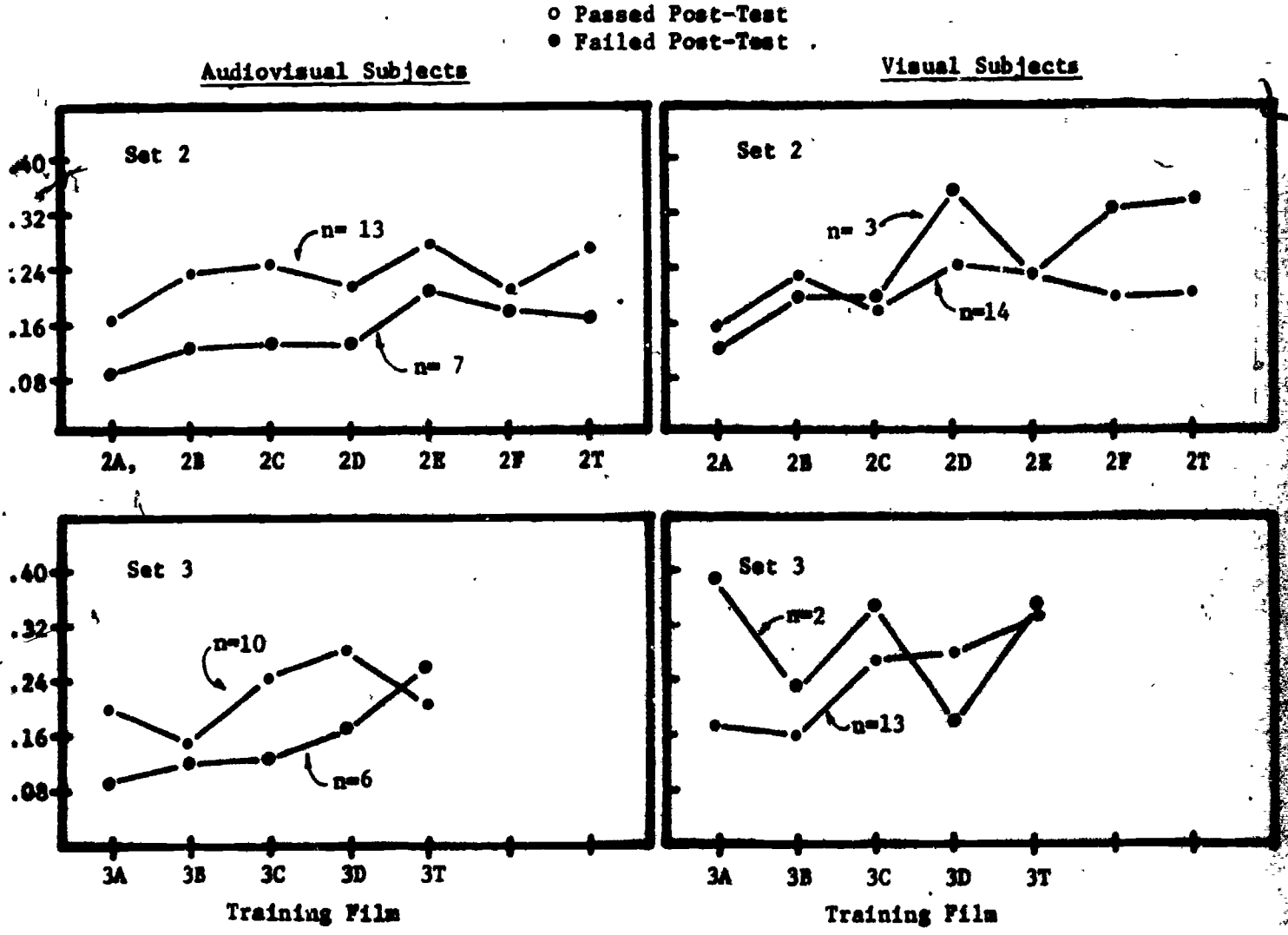


Figure 8. Mean proportion error functions for Audiovisual and Visual subjects who passed and failed the Auditory Post-Test.

who passed the Post-Test. Analysis of subject errors in Set 3 yielded $t = 2.40$, 14 df, significant at the .05 level. The corresponding $t = 1.70$, 18 df, for Set 2 was not significant. Examination of error functions produced by the Visual group reveals no consistent pattern. Those who passed did not differ significantly from those who failed the Post-Test.

A pattern of results has emerged that describes the observed effects of supplemental auditory cues on language learning. When language training first was introduced to lower primary subjects, audiovisual training was superior to visual training. This was reflected in the significantly lower error rates in Set 1 for the Audiovisual group (Figure 5). As training progressed the presence of the auditory component continued to facilitate learning by subjects who could discriminate sentences auditorily. Supporting evidence was the lower error rates found in Set 2 and Set 3 for the Audiovisual groups who passed the Auditory Post-Test (Figures 5 and 8). It appears that auditory supplementation increased overall learning since lower error rates were found on training frames without auditory cues as well as those with an auditory message (Figure 7).

(Receptive Generalization Tests). The next question was whether subjects in the Audiovisual groups would yield higher scores on the Receptive Generalization Tests administered periodically throughout training. For the analysis of the generalization data an RGT score was computed for each subject, based on all RGT's completed during the training period. The number of correct responses was summed over all tests and then converted to a proportion relative to the total number of possible responses. Data then were categorized according to experimental treatment, Audiovisual or Visual, and Post-Test performance. In Table 8 the means and standard deviations of RGT scores are presented for

Sets 1, 2, and 3. Relationships among the mean values correspond closely to those produced during programmed training. Subjects in Audiovisual groups had higher scores than subjects in Visual groups and within the

	Passed Post-Test		Failed Post-Test	
	Audiovisual	Visual	Audiovisual	Visual
Set 1			.85 (.10)	.76 (.17)
Set 2	.86 (.01)	.72 (.19)	.80 (.01)	.74 (.16)
Set 3	.86 (.10)	.82 (.05)	.78 (.12)	.71 (.16)

Table 8. Mean proportion correct scores and standard deviations ( ) on Receptive Generalization Tests for subjects who completed Sets 1, 2, and 3.

Audiovisual condition subjects who passed the Post-Test performed better than those who failed the auditory discrimination test.

Upper Primary Subjects. As noted above, the effects of sensory modality depended upon the starting level of training as well as the subjects' ability to discriminate auditory stimuli. Data for upper primary subjects were analyzed in terms of error rates during training and receptive and expressive generalization test performance.

(Language training). Language training data derived from upper primary subjects showed a decreasing effect of the auditory supplement as subjects advanced through the later Sets of training films. Sufficient numbers of subjects completed Sets 4, 5, 6, and Sets 14 and 15 to warrant an analysis. Experimental subgroups were formed according to Auditory Post-Test score and sensory condition; however Sets 14 and 15 included only one subject who failed the Post-Test, precluding an analysis for that variable.

In Figures 9 and 10 error functions for Audiovisual and Visual groups are

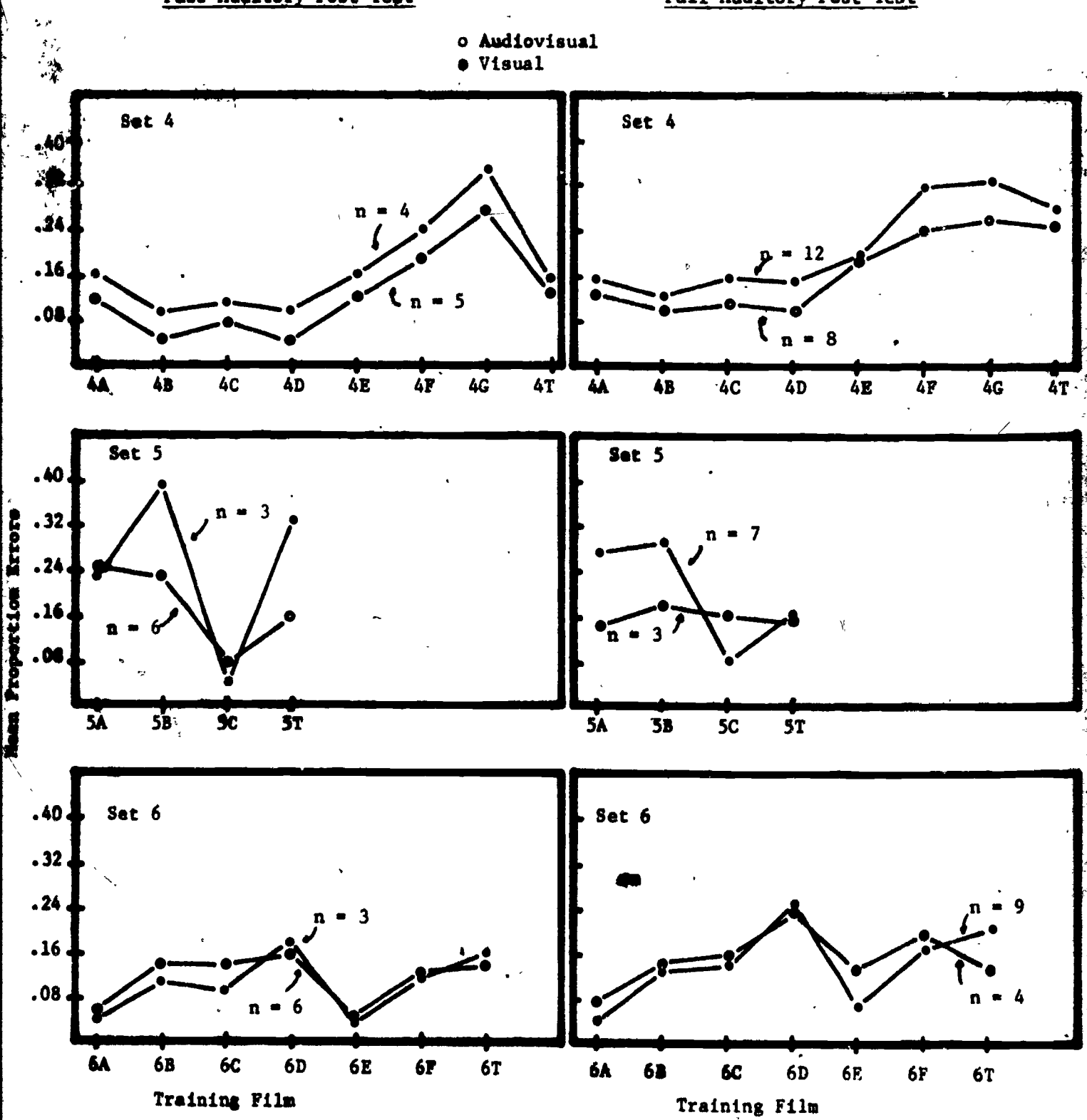


Figure 9. Comparison of mean proportion errors under audiovisual and visual training for subjects who passed and failed the Auditory Post-Test-Sets 4, 5, and 6.

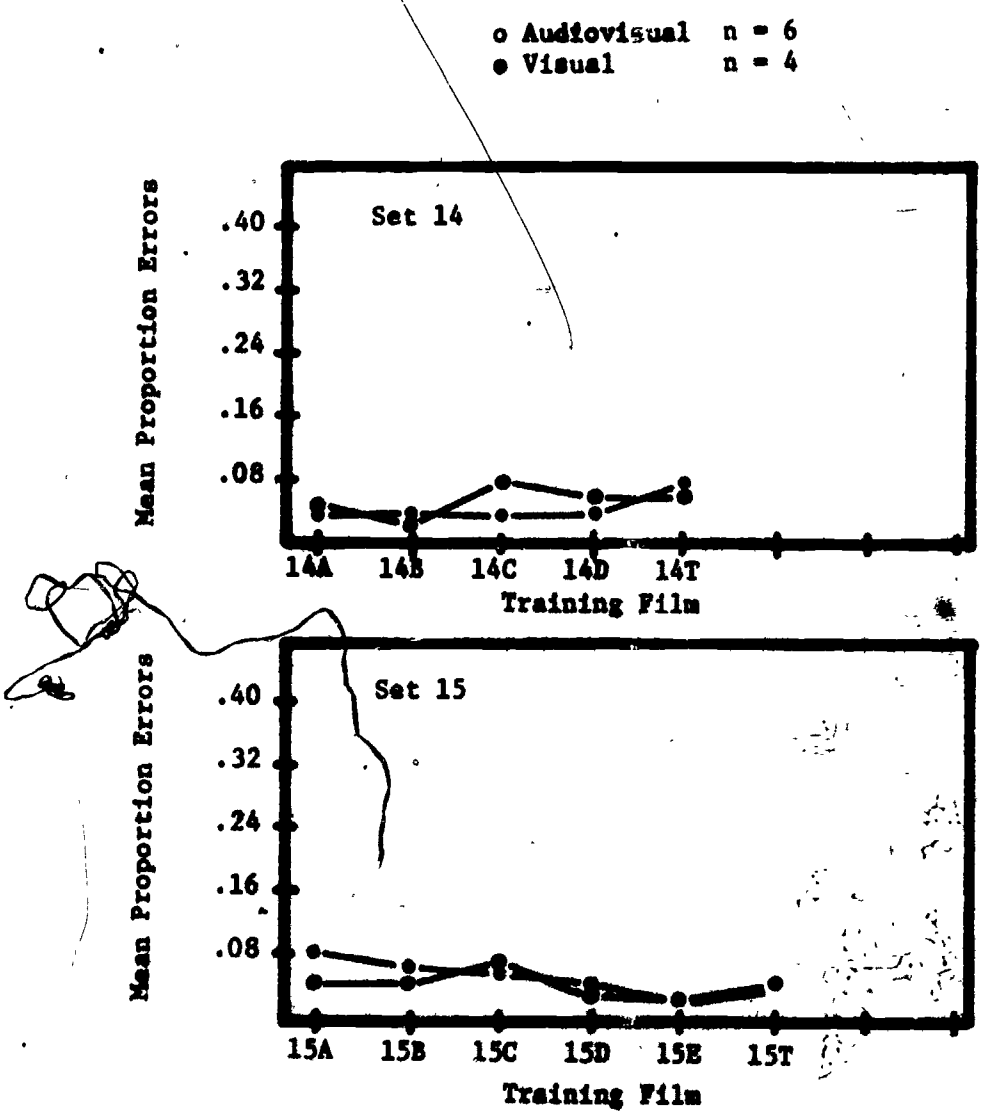


Figure 10. Comparisons of mean proportion errors under audiovisual and visual training for subjects who passed the Auditory Post-Test-Sets 14 and 15.

compared for subjects passing and failing the Auditory Post-Test. For all comparisons except Set 4 the curves for the A and V groups are intertwined indicating that the auditory supplement had no effect. Comparing A and V groups in Set 4, consistently lower mean proportions were produced by subjects in the Audiovisual groups, regardless of Post-Test score. Statistical analysis of the error rates for subjects in Set 4 revealed that the differences were not significant.

Similar results were found when subjects who passed the Post-Test were compared to those who failed. Within each sensory condition subjects who passed yielded slightly lower error rates in several Sets, but the mean differences between groups were not significant.

(Receptive Generalization Tests). Performance on the Receptive Generalization Tests generally was consistent with the results found during language training. Mean proportion correct responses on RGT tests (Table 9) showed little or no effect of sensory condition during training. In Sets 5, 6, 14, and 15 the A and V groups achieved almost identical values; in Set 4 the A

	Passed Post-Test		Failed Post-Test	
	Audiovisual	Visual	Audiovisual	Visual
Set 4	.89 (.06)	.85 (.02)	.82 (.10)	.74 (.12)
Set 5	.92 (.04)	.88 (.02)	.77 (.01)	.77 (.11)
Set 6	.88 (.06)	.88 (.02)	.79 (.10)	.81 (.08)
Sets 14, 15	.88 (.06)	.87 (.08)		

Table 9. Mean proportion correct scores and standard deviations ( ) on Receptive Generalization Tests for subjects who completed Sets 4, 5, 6, 14 and 15.

group scored slightly higher than the V group. Also, subjects in Sets 4, 5,

and 6 who passed the Post-Test tended to exhibit higher scores than those who failed, although during training no consistent differences were found.

(Expressive Generalization Tests). Approximately once a week each upper primary student was asked to complete one of the seven EGT's; the order of administration was randomized for each subject. Number of responses varied from 6 to 14 with a median of 7 responses. A total of 233 EGT's were administered to 42 subjects. Each response was designated "covered" or "not covered" according to whether the subject had received filmstrip drill on the vocabulary item used in the response. Table 10 shows the EGT performance of the experimental subgroups.

	Passed Post-Test		Failed Post-Test	
	Audiovisual	Visual	Audiovisual	Visual
Number of subjects	15	8	5	14
Covered Material	.63	.51	.58	.56
Material not yet covered	.37	.31	.40	.32

Table 10. Mean proportion correct scores on Expressive Generalization Tests for upper primary subjects.

It is apparent that previous filmstrip drill improved expressive test performance since the means for covered material were higher than means for uncovered material. As was observed in analyses of other performance measures, there were no clear differences between experimental groups.

Responses from the EGT's were divided into noun phrases and verb phrases for covered material and material not covered. Although more uncovered noun than verb phrases were correctly written (.46 correct nouns; .28 verbs) noun phrases showed greater improvement as training progressed: covered noun phrases

were 73 percent correct, an increase of 27 percent, while covered verb phrases rose only 16 percent from 28 percent to 44 percent correct. Emphasizing the problems associated with verb forms, programmed training on the use of "is...ing" and "are...ing" began in Set 1 and was repeated in most of the later Sets with a variety of verbs. Nevertheless, the present progressive tense was used correctly in only 39 percent of the responses. Use of the auxilliary was correct in 55 percent of responses and use of "ing" in 56 percent. Within the noun phrases articles also were introduced in Set 1 and these were used correctly in 65 percent of relevant noun phrases.

(Relationships among measures). Three primary measures of language learning were obtained for all subjects: (1) mean proportion errors per filmstrip, (2) mean proportion errors on review tests, and (3) mean proportion correct on Receptive Generalization Tests. Correlational analysis applied to data for 83 lower and upper elementary subjects yielded the coefficients presented in Table 11. All of the Pearson Product Moment correlation coefficients were significant at the .01 level. As error rates for subjects decreased on training films and review test films their correct responding increased on

	Mean Proportion Error-Review Tests	Mean Proportion Correct-RGT's
Mean Proportion Error-Training Film	.93	-.59
Mean Proportion Error-Review Tests		-.59

Table 11. Pearson Product Moment correlation coefficients between three measures of language learning.

Receptive Generalization Tests.

An additional analysis including Expressive Generalization Test data was possible for 38 upper primary subjects. Correlation coefficients for this

subgroup are shown in Table 12. Again all values meet the .01 level of confidence. The strongest relationship was found between error rates on training films and review test films. Although less strong, the correlations

	Mean Proportion Error-Review Tests	Mean Proportion Correct-RGT's	Mean Proportion Correct-EGT's
Mean Proportion Error-Training Films	.71	-.47	-.67

Table 12. Pearson Product Moment correlation coefficients for upper primary subjects on four measures of language learning.

between training films and both RGT and EGT scores also were significant.

Curiously the expressive test performance of more advanced subjects correlated more highly with training performance than did receptive test performance. Perhaps the ability to produce written language is a more sensitive measure of language competence.

Pre-Reading Subjects. Films from the Language Training Series were too difficult for the majority of the pre-reading subjects, ruling out an analysis of the experimental variables. Table 13 summarizes the terminal level of training for the 35 subjects in the pre-reading group.

Of the 35 language impaired or hearing impaired subjects who participated in the experiment only two were able to progress successfully from the Perceptual Training Series to the Language Training Series, concluding training on film 1D in Set 1. It was observed that even these two subjects found that increments in difficulty were large from film to film. Four additional subjects progressed to film 1B but only with considerable help from an experimenter.

Remaining subjects required several practice sessions before they learned

	Language Impaired	Hearing Impaired
Language Series		
1D	1	1
1A or 1B	1	6
ceptual Series		
P6 or P8	10	11
Unable to operate gram Master	3	2
	15	20

Table 13. Distribution of terminal training levels for pre-reading subjects.

the sequence of responses required to operate the Program Master. As the perceptual training material became more difficult for these subjects mechanical errors of operation increased. Subjects might correctly match the stimulus and response and then push the incorrect response button. Frequently subjects 'gave up' when a high degree of concentration was required and randomly pushed buttons until the GO button lighted.

The results of this portion of the experiment indicate that the Project LIFE Language Training Series, dependent as it is on written and pictorial language, was not an effective language supplement for pre-reading language impaired or hearing impaired children.

Discussion

Several hypotheses were entertained to explain the positive effect of supplemental auditory cues in the lower primary groups. One argument notes that younger subjects had little or no established incorrect habits with regard to the material presented by the training filmstrips. Upper primary subjects perhaps were more influenced by their prior academic experience and therefore less

affected by the sensory modality under which they received training. A second possibility concerns the way in which subjects processed auditory information. It might be hypothesized that younger subjects were more receptive to utilizing auditory cues while older subjects had become dependent upon visual cues in learning situations.

Some comments also can be made about the absence of a significant effect associated with the token reinforcement program. Clinical impressions formed during the course of the experiment suggested different explanations for the younger and older groups of subjects. It appeared that the token system was too complex; some of the younger subjects had no clear understanding of the reinforcement contingencies. Furthermore, during training tokens were administered only at the end of each session, a delay that may have made it difficult for subjects to associate the number of tokens earned with performance on the filmstrips. When training films required concentration and effort the behavior of some lower primary subjects was similar to that of the pre-reading subjects described above. If some subjects were affected by the token program it was not evident in the group as a whole.

In the case of upper primary subjects there seemed to be more motivation to perform correctly, but the intrinsic reinforcement provided by the GO button and the cumulative error counter was sufficient to sustain a high level of correct responding.

Another prominent aspect of the data was the large variability found associated with between-subject and within-subject measures. Between-subject variance was influenced by the prior history of the subjects as well as by their hearing status and other individual differences. One of the more striking observations was that several subjects with moderate hearing losses failed the

sentence discrimination test while others with more severe losses passed. Within-subject variability could be accounted for in part by the experiences subjects encountered during the school routine prior to their daily training sessions. It was impossible to quantify occasions when a subject had a 'bad day' or was ill, but it appeared that instability in performance could occur for these reasons.

The variability encountered in subject performance is not unique to this research but is frequently noted in other field research of this type. Additionally, the general area of rehabilitative audiology as such has had only minimal attention in terms of scientific investigation and thus has not developed the strategies available in other areas of audiology for isolating and controlling variables as can be accomplished in experimental laboratory settings. Upon discussing the status of and needs for research in aural rehabilitation, Jerger (1968) elaborated upon one of five barriers to research in aural rehabilitation cited by Oyer in a previous conference sponsored by the Miami Medical School. This barrier was lack of adequate test instruments. He suggests that tools are needed for measuring speech understanding and quantifying handicap. Were we to have available the tools for determining discrimination loss in relation to level of handicap, the apparent variability of results would not be quite so perplexing.

RETENTION AND RELEARNING EXPERIMENT

Purpose

The goal of the retention study was to determine the extent to which language learning was retained over a time interval ranging from three to six months. A group of subjects who participated in the pilot study completed original training six months prior to the retention test, but for the majority of subjects original training was completed at the end of the academic year. Three months later, after the summer recess, review test films from the Language Training Series were readministered to measure retention. Measures also were obtained for relearning the programmed training films that had been completed during the main experiment.

Method

Subjects

Subjects included 24 lower primary students and three upper primary students. This group represented all hearing impaired subjects at Woodcreek School who participated in the original experiment and returned to school after the summer recess. Although originally there were six subjects at the upper primary level, three of these students were integrated into their local public schools before the retention study began.

Equipment and Materials

Five Project LIFE units were established in the same room that was utilized during the main experiment. Responses were recorded on an Esterline-Angus 20 channel chart recorder.

The previous token reinforcement program was replaced by a system that displayed graphically the subjects' proportions of correct responses. For each subject an 8 1/2 x 11 chart was prepared similar to that shown in Figure 11. After a film was completed the experimenter converted the number

of correct responses into a proportion relative to the number of frames on the filmstrip. The height of the bar represented the proportion correct.

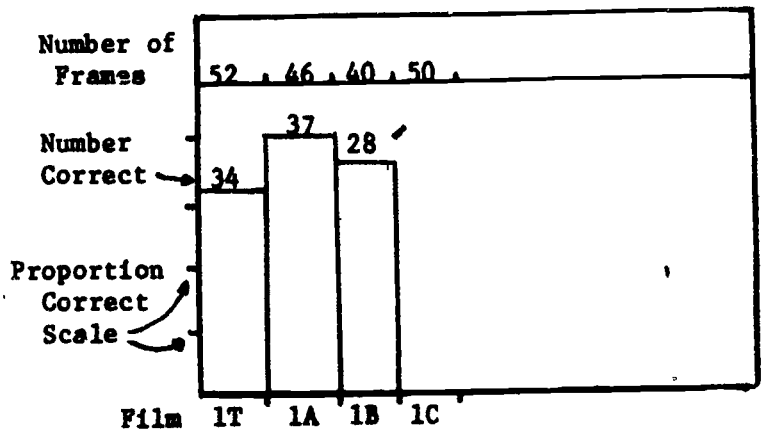


Figure 11. Chart displaying proportinate number of correct responses for each filmstrip.

The number of correct responses was written at the top of the bar which was filled in with a red ink marker before the subject left the test room.

During this phase of the research no generalization tests were administered. Assignment of subjects to sensory conditions remained unchanged.

Procedure

In the initial experimental session subjects were administered the review test film for the first Set that had been completed during the previous experiment. Training films within the Set were then administered to assess relearning performance. Finally, the review film was administered once again after relearning. Subjects repeated the same schedule for succeeding Sets: (1) review test for i ntion, (2) relearning of training films, and (3) the final review test after relearning.

There were 19 subjects who took part in the retention and relearning phase for Set 1 and Set 2; nine subjects completed Set 3; and three subjects completed Set 4 and Set 5.

Results

Retention

In the retention phase of the experiment lower primary subjects were administered review tests for training films in Sets 1, 2, and 3. Error scores from these tests were compared to scores obtained during original training three to six months earlier. Table 14 lists the mean proportion errors made on the original and retention tests. Retention scores for Set 1 and Set 2 were lower than original test scores showing an improvement of 8 percent and 7 percent respectively. When t-tests for repeated measures were applied to the data the decrease in mean errors was significant for Set 1.

Lower Primary	Original Test	Retention Test	Mean Difference	df	t
Set 1	.22	.14	.08	18	*2.77
Set 2	.30	.23	.07	18	1.82
Set 3	.40	.40	.00	-	-
Upper Primary					
Set 4	.13	.12	.01	-	-
Set 5	.05	.09	.04	-	-

* $p \leq .05$

Table 14. Mean proportion errors on original and retention tests with t values derived from repeated measures analyses.

The significant decrease in errors for Set 1 suggests that subjects internalized their previous learning during the interval between original learning and the retention test. Examination of the mean differences between the original and retention tests reveals that retention was greatest when errors on the original test were lowest. If the material was not learned as well during original

training then retention measures showed less improvement over time.

The three upper primary subjects exhibited very little change over the retention interval (Table 14). Mean errors were low on both the original and retention test for Set 4 and Set 5.

Relearning

When lower primary subjects undertook relearning of the training films administered in the main experiment there was a consistent reduction in erro in Set 1, Set 2, and Set 3 (Figure 12). Error functions produced during relearning paralleled those obtained in original learning showing very similar patterns of difficulty for films within the Sets. The mean differences in error rate averaged over the training films in each Set are given in Table 15 with corresponding t values obtained from repeated measures analyses.

Lower Primary	Original Learning	Relearning	Mean Difference	df	t
Set 1	.19	.12	.07	18	* 2.43
Set 2	.23	.13	.10	18	* 3.89
Set 3	.27	.18	.09	8	2.00
Upper Primary					
Set 4	.14	.08	.06	2	1.20
Set 5	.19	.04	.15	2	3.47

* $p \leq .05$

Table 15. Mean proportion errors on training films during original learning and relearning.

Gains in performance during relearning were significant in Set 1 and Set 2, but the 9 percent mean gain in Set 3 was not significant due to greater variability among subjects and the smaller sample size.

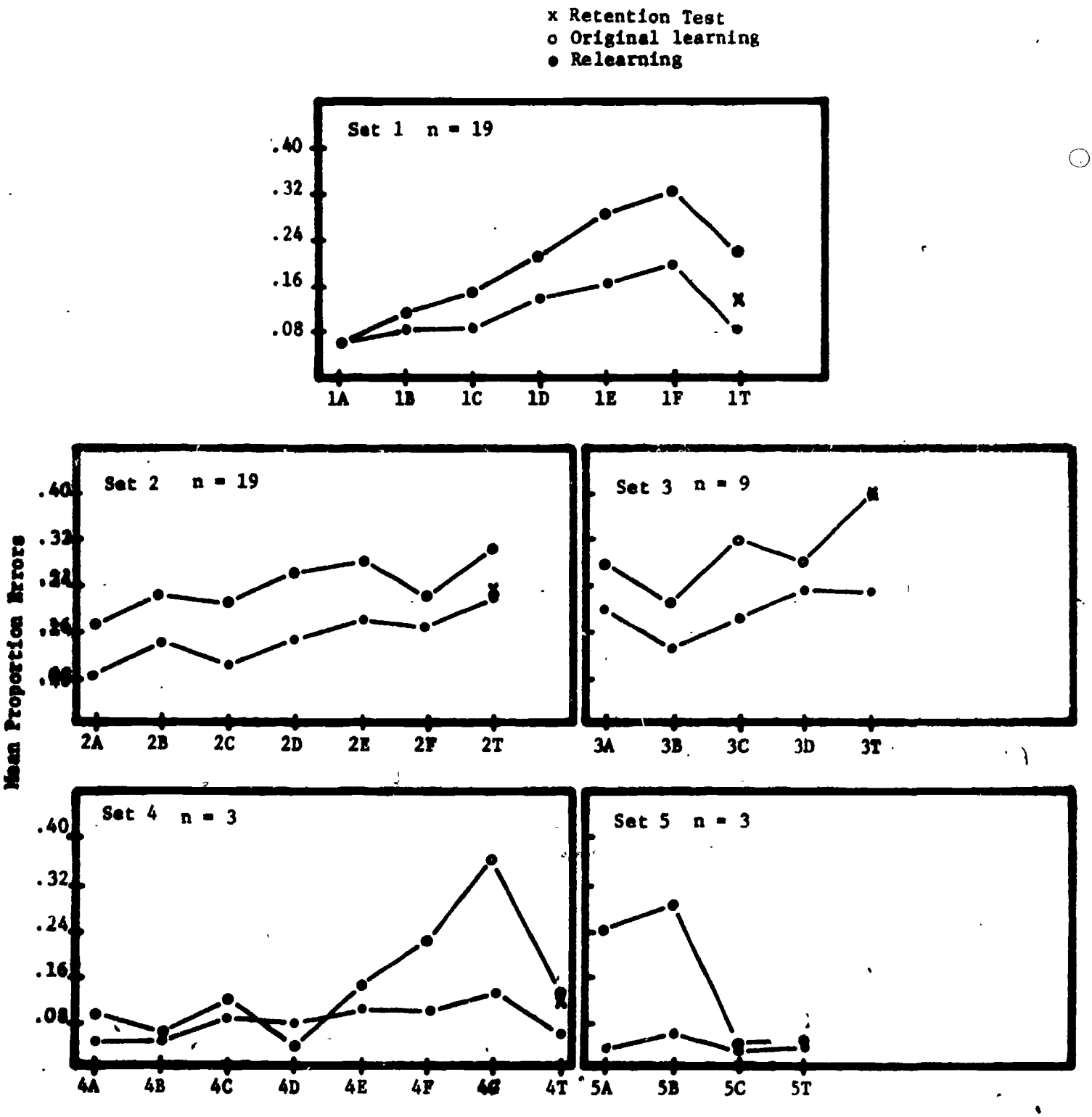


Figure 12. Comparisons of mean proportion errors produced during original learning and relearning. Data for Sets 1-3 are for lower primary subjects; Sets 4-5 for upper primary subjects.

Performance of lower primary subjects on the training films during relearning was consistently superior to performance during original learning. The next question was whether error rates on the final review tests after relearning would be lower than error rates on the original tests administered three to six months earlier. In Table 16 it can be seen that mean errors decreased on the final test for all three Sets. Differences between mean proportion errors on the original and final tests were significant in Set 1 and Set 3.

Lower Primary	Original Test	Final Test	Mean Difference	df	t
Set 1	.22	.08	.14	18	* 5.38
Set 2	.30	.22	.08	18	1.77
Set 3	.40	.23	.17	8	* 3.87
Upper Primary					
Set 4	.13	.06	.07	-	-
Set 5	.05	.04	.01	-	-

* $p \leq .05$

Table 16. Mean proportion errors on original and final administration of review test films.

Original and relearning data for Set 4 and Set 5, shown in Figure 12 and Tables 15 and 16, were obtained from upper primary subjects. The most prominent change during relearning was the elimination of peaks in errors found at the end of Set 4 and the beginning of Set 5 during original learning. With only three subjects in the group, none of the differences was significant even through errors made during relearning of Set 5 were 15 percent below the average in original learning.

When subjects first were introduced to Project LIFE language training the mean errors of lower primary subjects exceeded 20 percent on the last three training films in Set 1, the last five films in Set 2, and all of the Set 3 films. In contrast, errors for the same subjects during relearning exceeded 20 percent only once, on film 3D. A similar reduction in errors by upper primary subjects was found on four films in Set 4 and Set 5, the only occasions where error rates were high during original training.

Sensory Modality

Some of the subjects in the retention study had received audiovisual training during the main experiment and others had received visual training; this assignment was maintained during retention and relearning. In order to assess retention associated with the two sensory conditions average error rates were computed for each group on the original review tests and the retention tests for Set 1 and Set 2. The mean proportion errors are shown in Table 17 with associated values of t derived from repeated measures analyses of the difference scores. In Set 1 the mean reduction in errors for Audiovisual subjects approaches the critical value of $t = 2.78$ but fails to reach significance at the .05 level. Nevertheless, the pattern of difference scores corresponds closely with the results of training in the main experiment. All groups exhibited some improvement on the retention tests with a trend toward greater gains in the Audiovisual groups.

Set 1	Original Test	Retention Test	Mean Difference	df	t
Audiovisual	.26	.14	.12	4	2.64
Visual	.20	.15	.05	13	1.72
Set 2					
Audiovisual	.35	.23	.12	6	1.39
Visual	.27	.23	.04	11	1.21

Table 17. Mean proportion errors on original and retention tests for subjects in audiovisual and visual training groups.

Retention Interval

Since seven subjects in the retention experiment had participated in the pilot study six months earlier and the remaining 12 subjects had only a three month interval, it was decided to analyse retention and relearning data separately for these two subgroups. Mean proportion error scores calculated for the original and retention tests of Set 1 and Set 2 are listed in Table 18. Improvement on the retention tests was not restricted to subjects with the shorter retention interval; regardless of the time between original and retention testing there were reductions in errors over time. Relearning curves also reflect the negligible effect of length of retention interval. In Figure 13 the three month group improved relatively more in Set 1 and the six month group made greater gains in Set 2.

	Original Test	Retention Test	Mean Difference
Set 1			
3 - months	.22	.13	.09
6 - months	.22	.17	.05
Set 2			
3 - months	.28	.23	.05
6 - months	.34	.24	.10

Table 18. Mean proportion errors on original and retention tests after a 6 - month and 3 - month retention interval.

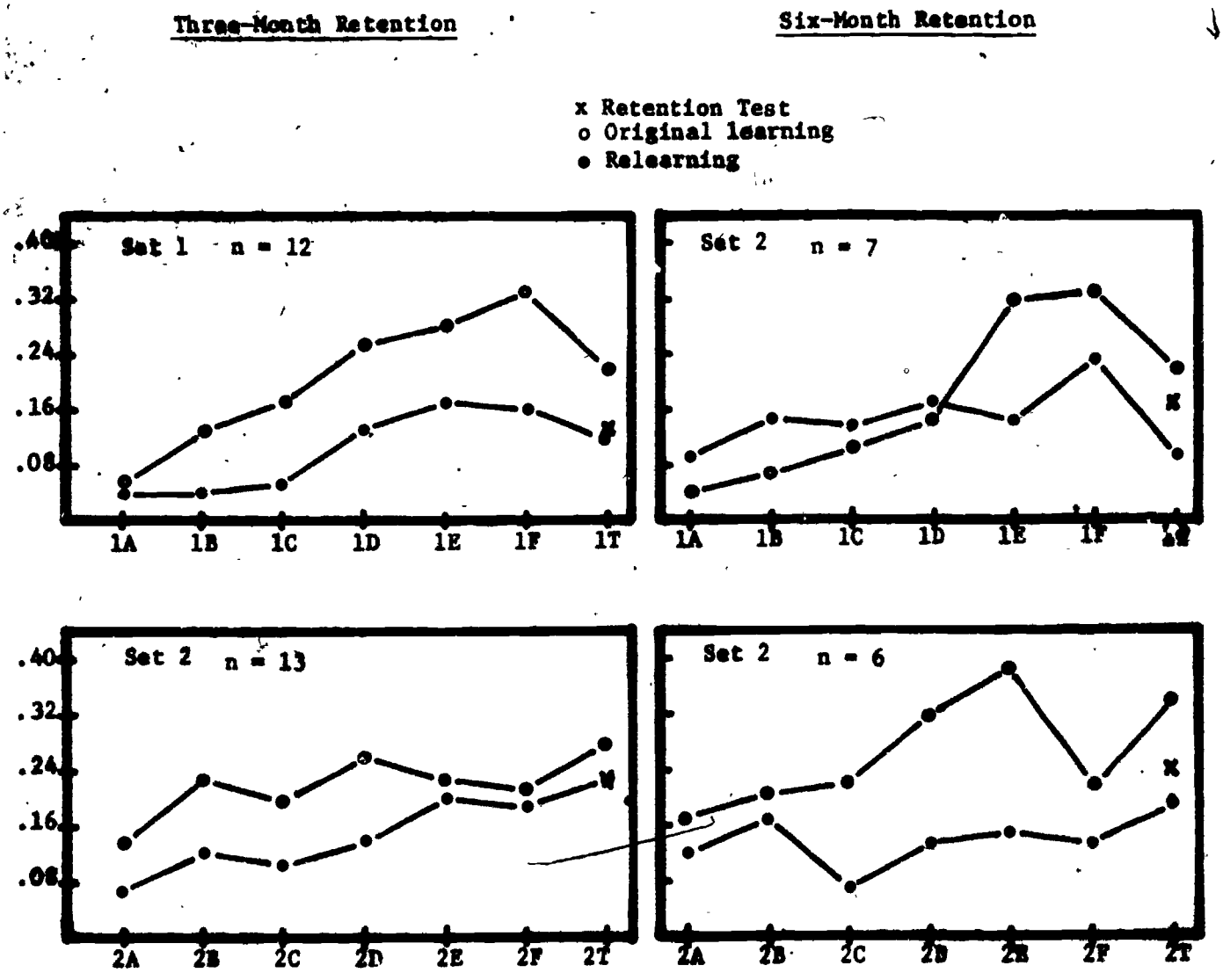


Figure 13. Mean proportion errors during original learning and relearning for subjects with three-month and six-month retention intervals.

Discussion

In the evaluation of educational programs, measures of retention of material learned during the instructional period often are neglected, yet the effectiveness of the program must be judged by this criterion. Although immediate or short term retention is occasionally sufficient, in the educational process it is long term effects that assume the most importance.

The present experiment found strong evidence that learning of language structures presented through the Project LIFE instructional program was retained over a three to six month interval. Young hearing impaired subjects from six to eight years old received training on language structures that had not yet been presented in their regular language curriculum. Under these conditions retention tests showed no loss over time and performance appeared to improve in some instances.

When retention was considered as a function of sensory condition during training there was a tendency for subjects who received supplemental auditory cues to improve more over the retention interval than subjects under the visual training condition. This lends further support to the argument developed in the main experiment where the Audiovisual groups produced fewer errors during original learning and higher percentages of correct responding on Receptive Generalization Tests.

It can be concluded that readministration of training films was an effective procedure for reinforcing original learning. Relearning of the training films resulted in substantial reductions in errors averaging from 7 percent to 10 percent for the first three Sets. During original training there were three subjects whose average errors exceeded 30 percent on the films in Set 1, suggesting an insecure grasp of these language structures. Upon relearning the same films, their errors were reduced to approximately 13 percent.

Similarly, five subjects with error rates between 20 and 30 percent originally produced an average of 10 percent errors per film during relearning. The present investigators believe on the basis of these results that subjects should be allowed to complete a Set of training films even though their error rates are high and then should be given the same training Set at a later date. Immediate repetition of an individual film did not provide as effective a method of reducing errors.

Summary

This research employed Project LIFE programmed language instruction to assess the effects of auditory supplementation and a token reinforcement program on language learning by hearing impaired children. A second phase of the research investigated retention and relearning after a three to six month interval.

At the core of the Project LIFE instructional system is a series of programmed training filmstrips that progress in grammatical complexity over a series of filmed training Sets. Each frame of the training films presents a multiple-choice item, usually in the form of a pictorial stimulus with printed response alternatives. An optional auditory component was added to the system by utilizing automatic cassett/filmstrip sound projectors that transmitted recorded messages, synchronized with filmstrip advance, to subjects by earphones.

A total of 114 hearing impaired children and 15 normal hearing language impaired children participated daily in the experiment. Ages ranged from 4 to 13 years. Within classrooms, students were assigned to either a visual or audiovisual training modality and then subdivided further into a token and non-token reinforcement condition. In the token reinforcement program, bogus silver keys were awarded contingent upon the number of correct responses on the programmed training films. Keys later were exchanged for inexpensive novelties.

Subjects at the lower primary level began language training with the most elementary programmed training films in Set 1. Upper primary level subjects completed review tests for successive training Sets until they failed to reach a 70 percent criterion of correct responding. At this point they began film by film training within the Set that was failed.

Periodically throughout original training, subjects were administered general. tion tests so that transfer of learning to a similar receptive language task and to a written productive language task could be assessed. Receptive Generalization Tests required subjects to construct grammatical sentences by piecing together word and phrase segments in response to pictorial stimuli. Expressive Generalization Tests included written fill-in-the-blank test items that called for language structures presented on the training films.

An Auditory Post-Test consisting of eight sentence discrimination items was administered at the end of original training. Test sentences, similar to those introduced in the early programmed filmstrips, were presented through headphones. For each test item, subjects selected one of three pictures in the response set.

Three to six months after original training 27 subjects were tested for retention and relearning of the language structures previously presented. In order to test retention, review tests were administered for each Set of training films that subjects had completed earlier. Error rates on the retention tests could then be compared with performance on the same tests during the prior learning period. Following the administration of each retention test, subjects underwent relearning of training films within the Sets.

A number of summary measures were obtained for each experimental subgroup, including: (1) mean proportion error rates calculated for each Set of training films during learning and relearning; (2) proportion of correct responses on Receptive and Expressive Generalization Tests, and (3) mean proportion errors on review tests administered during original learning and again as retention tests.

The token program employed in the present research did not have an effect on performance during language training. During original learning, error rates of subjects in the token reinforcement program did not differ significantly from those of subjects who received no taken reinforcement.

The effect of supplemental auditory cues on language learning was a function of the level at which subjects started training and their discrimination ability for sentences presented auditorily. Auditory supplementation benefitted lower primary subjects who were exposed to new language structures during training. This effect was more prominent for subjects with good sentence discrimination ability. Under audiovisual training, error rates were lower during original training, scores on Receptive Generalization Tests were higher, and fewer errors were produced on retention tests three months after original training.

Subjects at the upper primary level showed little effect of the auditory supplement. As the starting level for language training became more advanced, discrepancies in error rates associated with visual and audiovisual conditions were reduced.

Upper primary subjects exhibited much poorer performance on Expressive Generalization Tests than on Receptive Generalization Tests. Incorrect responses were most frequent when fill-in-the-blank test items called for verb forms. Although performance on training films correlated significantly with both measures of generalization, the written expressive language task appeared to be a more sensitive measure.

The Project LIFE programmed language filmstrips were too difficult for kindergarten subjects at a pre-reading level. No subject in the hearing impaired or normal hearing language impaired group was able to complete Set 1 of training.

Retention measures for a subgroup of subjects from the main experiment indicated that there was no loss or forgetting over a three to six month interval. In some instances mean error scores on the retention tests were significantly lower than they were at the end of original training suggesting that subjects intermalized their learning during the retention interval. When subjects undertook relearning of programmed filmstrips that had been previously administered, there were substantial reductions in errors for both lower and upper primary subjects.

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CONCLUSIONS

(1) Primary students benefit from auditory supplementation of the Project LIFE language training filmstrips.

(Lower primary students, who may be receiving their initial exposure to a particular language structure via the Project LIFE program, show the greatest effects of audiovisual training, but most groups in the age range tested showed trends of improved performance.)

(2) Students using Project LIFE show no additional benefit from an extrinsic token reinforcement program.

(None of the learning, retention, or generalization measures used, and none of the age ranges tested, showed consistent differences between token and no-token subject groups. On the other hand, many students reacted favorably to seeing a graphic record of their daily performance.)

(3) Most children under six years of age do not perform consistently during Project LIFE instruction.

(Response patterns of students who have attended school a year and have had some reading instruction are generally more stable.)

(4) Students retain the receptive language skills acquired during Project LIFE instruction over an interval of at least six months.

(When retested, students showed no decrement in performance - on the contrary, they evidenced some internalization of the skills.)

(5) Original learning is reinforced when training films are readministered.

(Substantial gains in performance were realized for almost all students, although those who averaged 20 percent or more errors originally appeared to benefit the most.)

(6) Language skills acquired through Project LIFE training generalize to similar receptive language tasks and, to a lesser extent, to expressive language performance.

(Students using the Project LIFE system recognize the correct use of the structures so learned in other receptive situations and increase their correct expressive use of the structures. The improvement in written expressive behavior is, however, less than optimal.)

RECOMMENDATIONS

(1) Since this research has shown that there is a positive effect of auditory supplementation in the early years, an applied demonstration program is recommended. The major purpose would be to follow the progress of a group of students who receive Project LIFE instruction with auditory supplementation during three academic years, starting at the first grade level. The curriculum offered by their academic program would be coordinated with the sequence presented by Project LIFE. Students following the standard language curriculum would serve as a comparison group.

(2) A research project is needed to investigate ways to improve the generalization of language skills learned via Project LIFE to expressive behavior. One possible method for increasing generalization is requiring children to verbalize their responses as they progress through the Project LIFE filmstrips. Another is offering a programmed writing system which parallels the Project LIFE receptive training.

APPENDIX A

Receptive Generalization Tests

Key to Receptive Generalization Test Scripts

Abbreviations

E: experimenter NP: noun phrase

S: subject VP: verb phrase

Column Meanings

Item: designates printed material to be placed on magnetic board. A slash (/) designates division of a sentence into two or more portions. Material in parentheses indicates the correct response to be supplied by subject.

Foils: indicates the incorrect alternatives offered to subject when alternatives are pictures rather than words, only foils are listed since the correct picture is inferred from the item.

Action: gives instructions to E regarding sequence of his actions relative to S's.

RGT TEST 1 - Film 1A

Item	Foils	Action
1. baby		E puts out word, then puts picture above
woman		E puts out word, then puts picture above
girl	Pictures: man, boy	E puts out word, S puts picture above
2. boy		E puts up picture, then puts word under
girl		E puts up picture, then puts word under
(man)	woman baby	E puts up picture, S selects word

RGT TEST 2 - Films 1B,C

	Item	Foils	Action
1.	The baby is walking		E puts up sentence, then picture
	The woman is sitting.		E puts up sentence, then picture
	The boy is running.	Pictures: sitting man, walking girl	E puts up sentence, S selects picture
2.	The baby / is sleeping		E puts up NP, then picture, then VP
	The baby / is sitting.		E removes previous VP, puts up picture of sitting baby, then new VP
	The baby / (is walking.)	is sleeping. is sitting. is running.	E removes previous VP, puts all 4 choices before S, puts up picture of walking baby; then S selects verb
3.	The girl is sitting.		E puts up sentence, then picture
	The boy is sitting.	Pictures: sitting girl, sitting woman	E puts up sentence, S selects picture
	(The woman) / is sitting.	The man, The baby	

RGT TEST 3 - Films 1D, E, F

Item	Foils	Action
1. The man / is walking.		E puts up picture, then 2 phrases.
The boys / (are running.) is running.		E puts up 2 pictures, then NP; S selects VP
The girl is running.	Pictures: 2 girls running girl sitting	E puts up sentence, S selects picture
2. (The girls) / are sitting.	The girl The boy The baby	E puts up pictures: 2 girls sitting, TV set, then VP; S selects NP
(The babies are sleeping.)	The baby are sleeping.	E puts up picture of babies sleeping, and S selects sentence

RGT TEST 4 - Films 2A,B,C

Item	Foils	Action
		E puts out all S's choices
The man is walking.		E puts up picture, then phrase
(A cat) / is sleeping.	Some cat The cats	E puts up picture, then VP; S selects NP
(Some boys are running.)	A boys are running. The boys is running.	E puts up picture, S selects entire sentence
Some birds are flying.	Pictures: separate flying birds a dog	E puts up sentence, S picks pictures - must put up at least 2 separate pictures of birds
(A dog) / (is sitting.)	A dogs are sitting.	E puts up picture, S picks both phrases

RGT TEST 5 - Films 2D,E,F

Item	Foils	Action
		E puts up all choices for S, and puts TV up
The big girl is walking.		E puts up sentence, then picture
The man and the woman / (are sitting.)	is sitting. sitting.	E puts up phrase, S selects VP, then E puts up picture
(A little girl) / is running.	A girl little The little girls	E puts up VP, S selects NP, then picture; E puts cat running in front of little girl
(Some birds are sleeping.)	A bird is sleeping.	E puts up picture, S selects sentence

RGT TEST 6 - 3A,B

Item	Foils	Action
The dog is eating.		E puts up phrase, then picture
Some cats are drinking.	Pictures: 1 cat eating cat sleeping	E puts up sentence, S picks picture
The baby / (is eating a cookie.)	are eating a cookie. is drinking a cookie.	E puts up picture and NP; S selects VP
The little girl / (is eating an apple.)	is eating apples. are eating an apple.	E puts up picture, NP; S chooses VP
(The boy and the big girl) / (are eating meat.)	The boys The girls is eating meat. are standing.	E puts up picture, S selects both phrases

RGT TEST 7 - 3C,D

Item	Foils	Action
		E puts up background scene
The baby / (is drinking milk.)	is drank milk.	E puts up NP, S selects VP
The big cat / (ate the meat.)	is eating the milk. eated the meat.	E puts up NP, S selects VP
The water is running.		E puts up entire sentence
The man / (is drinking water.)	is drinking waters. are drinking waters.	E puts up NP, S selects VP
The boy and the girl / (drank some milk.)	are walking. is drinking milk.	S selects verb

RGT TEST 8 - 4A

Item	Foils	Action
		Six sets of pictures sequentially Boy walking along
(The dog) / is eating meat.	Some dogs Some cats	E puts up picture, then VP; S selects NP
(The boy has the meat.)	The boy had some meat. The boy have meat.	E puts meat with boy, S selects sentence
The boy and the dog / (are running.)	are sitting. is sitting.	E puts up pictures and NP; S selects VP
The dog / (has the meat.)	ate the meat. is drinking meat.	E puts up picture and NP; S selects VP
The dog / (ate the meat.)	is eating water. drank the water.	E puts up picture and NP; S chooses VP
The boy / (drank the milk) / and the dog / (is drinking water.)	ate the apple. have the water.	E puts up picture and "The boy"; S chooses first phrase; E puts up "and the dog"; S completes sentence

RGT TEST 9 - 4B,

Item	Foils	Action
The boy / (has one ball.)	have one ball. has one balloon.	E puts up picture & NP, S selects VP
The girl / (has two balls.)	has two dolls. has two ball.	E puts up picture & NP, S selects VP
The boy and the girl / (have three balls.)	has two balls. has three balls.	E puts up NP, S selects VP
The big boys / (have two airplanes.)	have three airplanes. have two cars.	E puts up pictures, noun; S selects VP
The girl and the boys are running.		E takes away above pictures, puts up running pictures, then entire sentence
	Pictures:	
The little boy has a wagon.	flower balloon	E puts up sentence and picture of boy; S chooses appropriate picture
The little boy / (has three balls) / and / (two airplanes) / (and one wagon.)	have three balls has two balls two airplane three airplanes and one wagons. and one flower.	E puts up noun and puts balls in wagon, S selects VP; then E puts planes in wagon and "and"; S selects phrase; S selects final phrase

RG1 TEST 10 - 4D,E,F,G

Item	Foils	Action
The man has some water.		E puts up picture (man pouring water into a dish)
(The woman) / has three apples and some meat.	The boy and girl The babies	E puts up end of sentence, S selects subject phrase and picture
	Pictures: boy with one apple girl with meat tray woman with two apples	
Two little blue birds / (are flying.)	is flying. is eating.	E puts up subject, S selects verb and picture
	Pictures: 1 big & 1 little blue 2 green & 1 blue	
(one red bird) / is drinking water.	Two red birds One green birds	E puts up red & yellow birds drunking water, two red birds sleeping, removes all people (but puts up food dishes), then puts up VP; S chooses NP
The yellow bird / (drank) / some water.	drinked is drinking	E puts up phrases, then removes drinking yellow bird & substitutes yellow bird walking away from plate; S selects verb
	Pictures:	
A big black and white bird is eating meat.	little black and white bird eating apple big black bird drinking little white bird eating meat	E puts up sentence, S selects picture

RGT TEST 11 - 5A,B,C

Item	Foils	Action
Who has the balloon? (The girl has the balloon.)	The boy have the balloon. The dogs has the balloon.	E puts up picture of girl with balloon on fingertips, then question; S chooses response
Two boys and a girl / (are playing with) / the green balloon.	is playing with played with	E puts up pictures of boys & moves balloon to air, then puts up most of sentence; S selects verb
(What) / is running?	Who	E puts up pictures of 2 cats sleeping and dog running toward balloon, then verb; S selects subject
(A dog is running.)	A dogs are running. A dog are running. A dogs is running.	S selects sentence
What has the balloon? (The dog has the balloon.)	A dog have the balloon. A boy has the balloon. The girl had the balloon.	E gives balloon to dog, then puts up question for S to answer
(A boy and girl) / are running.	The dog The girl	E changes children to 2 running, 1 sitting, then puts up verb; S selects NP
The balloon went BANG.		E takes away balloon & run-ing kids, puts up dog sitting with deflated balloon & kids standing

RGT TEST 12 - 6A,B,C

Item	Foils	Action
		E puts up background scene
Bob has blue / (eyes) / and / (blond) / hair.	nose brown ears	E points to Bob and puts up phrases; S fills in nouns
Mary and Bob / (are playing with) / the cars and the dolls.	is playing with played with	E puts out most of sentence, S selects verb
Who has the dolls? (Mary has the dolls.)	Ann had the dolls. Bob have the dolls.	E puts up question; S chooses response
(Two birds) / are blue and one bird / (is brown.)	A bird The cats Two dogs are blue. is blond.	E puts up "and one bird"; S selects phrase
The cat has / (yellow) / eyes.	balloon white blond	E puts up sentence, S selects adjective

RGT TEST 13 - 6D,E,F

Item	Foils	Action
(Joe has) / black hair and brown eyes.	Joe is Joe are Joe have	E puts up picture of Joe, then phrase; S selects beginning
(He has) / some balloons.	What has It has She has	E puts balloons in Joe's hand, then sentence; S completes
Bob has / (a big kite.)	a big boat. a big flower. a big doll.	E puts up Bob (offering Joe the kite) and phrase; S puts up end of sentence
(It is yellow.)	He is yellow. She has yellow. She are yellow.	S selects entire sentence
The kite and some balloons / (are yellow.)	have yellow. is yellow.	E puts up phrase; S completes
(Ann and Mary have) / a little wagon.	Ann and Mary had Ann and Mary are Ann and Mary is	E puts up picture of girls with wagon, then phrase; S selects rest
Joe has / (the kite and the little wagon.)	the kite the little wagon. the kite who the wagon.	E puts kite in wagon of Joe and phrase; S completes sentence

RGT TEST 14 - 7A,B,C,D

Item	Foils	Action
		E puts up background scene; puts separate caps with others
(Ann's dress) / is green and white	Mary's coat Bob cap	E puts up phrase; S completes
(She has a doll.)	The boy has a doll. He has a doll.	S chooses entire sentence
(The boy's shirt) / is blue.	The girl's doll The doll's shoes	E puts up phrase; S completes
Who has a white coat? (the woman)	the man the boy	E puts up question; S answers
Who has black shoes? (The man's shoes are black.)	The man have black shoes. The man are black shoes.	E puts up question; S answers
Ann and the boy have red / (caps.)	shoes. pants.	E puts caps on children, puts up phrase; S completes
(The boy's) / cap is red.	The boys The boy	E puts up phrase, S selects subject

RGT TEST 15 - 8A,B,C,D

Item	Foils	Action
		E puts up backgroun puts Mary and Bob on sofa
Ann is eating / (in the kitchen.)	in the bathroom. on the room.	E puts Ann in kitch table, then puts completes
Mary and Bob are sitting / (on the sofa) / in the living room.	in the sofa in the sink	E puts up sentence
Bob has a big brown / (box.)	stove. basket.	E puts box in Bob's most of sentence; completion.
He has a car and a boat / (in it.)	on it. under it.	E puts up first par S finishes it
Ann, Mary and Bob are / (in Ann's bedroom.)	in Ann's bathroom. in Ann's living room.	E takes away box, p bedroom and lamp puts up sentence
The girls and the boy / (are jumping on the bed.)	are flying on the bed. are sleeping in the bed.	E puts children jum sentence part; S completion
The lamp is / (under the table.)	on the table. in the table.	E lets child knock under table, then part of sentence

RGT TEST 15 - 8A,B,C,D

	Foils	Action
		E puts up background scene, then puts Mary and Bob in livingroom on sofa
kitchen.)	in the bathroom. on the room.	E puts Ann in kitchen eating at table, then puts up phrase; S completes
g / (on the room.	in the sofa in the sink	E puts up sentence part; S completes
(box.)	stove. basket.	E puts box in Bob's hands and puts up most of sentence; S chooses completion.
/ (in it.)	on it. under it.	E puts up first part of sentence; S finishes it
(in Ann's	in Ann's bathroom. in Ann's living room.	E takes away box, puts children in bedroom and lamp on table, then puts up sentence part; S completes
(are	are flying on the bed. are sleeping in the bed.	E puts children jumping on bed & sentence part; S selects sentence completion
e table.)	on the table. in the table.	E lets child knock lamp off & puts it under table, then puts up first part of sentence for S to complete

RGT TEST 16 - 9A,B,C

Item	Foils	Action
		E puts up backgrou Bob as pitcher, Joe up at bat
(Joe is hitting) / the ball.	Joe hit Joe are hitting	E takes bat & ball it; then puts up completes it
(Joe hit) / the ball and / (ran to Ann.)	Joe hitted Joe are hitting are running to Ann. is running on Ann.	E has Joe hit the Ann, then puts u completes it
The teacher is walking / (to the boys and girls.)	in the boys and girls. on the boys and girls. under the boys and girls.	E makes teacher wa then puts up sen complete
The boys and girls are walking to / (the school.)	the sink. the sofa.	E has children & t school, then put S to complete
The teacher has some / (paper and pencils) / (on her desk.)	book pencil on his desk. on hit desk.	E puts up incomple completes; E put children in scho
Bob is riding to his house / (on his bike.)	in his bike. on her bike.	E puts Bob on bike bus (removing ol puts up sentence
Ann and Joe / (are riding in the bus.)	is riding in the bus. are riding to the bus.	E puts up incomple completes senten

	Foils	Action
		E puts up background scene, puts Bob as pitcher, Ann at first, Joe up at bat
ball.'	Joe hit Joe are hitting	E takes bat & ball and has Joe hit it, then puts up phrase; S completes it
	Joe hitted Joe are hitting	E has Joe hit the ball & run to Ann, then puts up sentence; S completes it
	are running to Ann. is running on Ann.	
.)	in the boys and girls. on the boys and girls. under the boys and girls.	E makes teacher walk toward children, then puts up sentence for S to complete
alking	the sink. the sofa.	E has children & teacher walk to school, then puts up sentence for S to complete
paper and k.)	book pencil	E puts up incomplete sentence; S completes; E puts teacher and children in schoolroom
	on his desk. on hit desk.	
se / (on	in his bike. on her bike.	E puts Bob on bike, Joe and Ann in bus (removing old kids), then puts up sentence for S to complete
in the bus.)	is riding in the bus. are riding to the bus.	E puts up incomplete sentence; S completes sentence

RGT TEST 17 - 9D,E,F

Item	Foils	Action
Tom / (is pushing) / Barbara in her wagon.	are pushing are falling	E puts up picture, then sentence for S to complete
Tom is running and Barbara / (is falling.).	is reading. is writing.	E puts up picture of Tom running & makes Barb fall, then puts up sentence to be completed
Barbara / (fell) / (on her hands and knees.)	falled feet in her arm and leg. on his head and feet.	E puts Barb on her hands & knees then puts up sentence; S picks both phrases
Her knees / (hurt) / and / (she is crying.)	foot head she are crying. she is jumping.	E takes away old Barb and puts up picture of Barb crying; then puts up sentence; S chooses both phrases
(She cried and) / (ran home.)	She pushed and She ate and running school. has house.	E puts up Barb running home, then has S choose whole sentence in two parts

Item	Foils	Action
		E puts up backgrou (living room)
(I have) / some milk and / (you have) / some cookies.	She have He have	E puts cookies in full glasses of hands, then puts 2 parts; S fills
	we have they have	
(We have) / some cookies and milk.	They has Their have	E gives one glass one cookie to gi sentence; S comp
We are / (eating and talking) / in the living room.	ate and drank eat and reading	E puts up sentence
(We ate) / the cookies and (drank) / some milk.	We ea We eating	E takes away cooki glass of milk wi puts up incomple fills in
	drinking is drinking	
(We had) / cookies and milk.	We has We have	E puts up incomple finishes it
(I am happy!)	I is happy! I is sad!	S selects entire s
The dog and cat are in the living room.		E puts dog & cat i puts this up
(They are jumping) / on the sofa.	They is jumping They am jumping	E puts them jumpin puts up sentence
The milk is / (on the sofa.)	under the sofa. to the sofa.	E makes dog spill puts up incomple fills in
I am sad!		E puts up entire s

	Foils	Action
		E puts up background scene (living room)
nd / (you have) /	She have He have	E puts cookies in boy's hands, 2 full glasses of milk in girl's hands, then puts up sentence in 2 parts; S fills in
	we have they have	
es and milk.	They has Their have	E gives one glass of milk to boy, one cookie to girl, puts up sentence; S completes
alking) /	ate and drank eat and reading	E puts up sentence; S completes it
and (drank) /	We eat We eating	E takes away cookies & replaces full glass of milk with 1/4 full glass, puts up incomplete sentence; S fills in
	drinking is drinking	
milk.	We has We have	E puts up incomplete sentence; S finishes it
	I is happy! I is sad!	S selects entire sentence
the living room.		E puts dog & cat in picture, then puts this up
n the sofa.	They is jumping They am jumping	E puts them jumping on sofa, then puts up sentence for S to complete
sofa.)	under the sofa. to the sofa.	E makes dog spill milk on sofa & puts up incomplete sentence; S fills in
		E puts up entire sentence

Item	Foils	Action
		E puts kids in box in backyard
Suzi and Tony are sister and brother.		E puts up complete sentence
(They are playing) / in the big brown box.	Their are playing He are playing	E puts up phrase; S completes
(Their mother) / is walking to the box.	Their father Your father	E puts mother in scene & puts up phrase; S completes it
Tony: Hi, Mother.		E puts up balloon.
Mother: What are / (you doing?)	you wash? you dried?	E puts balloon above mother; S completes question
kids: We are playing in the box.		E puts up balloon
Mom: (Whose box) / is it?	His box Who box	E puts up balloon; S completes
kids: It is / (our box.)	she box its box.	E puts up balloon; S completes
Mom: It is dirty / (and you are dirty.)	and your dirty. and her are clean.	E puts up balloon; S completes
Mom: (Wash) / your hands and faces.	Will wash Am washing	E puts up balloon; S completes
Suzi is washing her face and Tony / (is washing) / his hands.	are washing wash	E puts kids in bathroom doing this, then phrase; S completes
(They are drying) / their hands and faces.	They will dry They dried	E puts up appropriate pictures, then sentence to be completed
They are clean!		E puts up pictures of clean kids & then puts up entire sentence

RGT TEST 20 - 12A,b,C

Item	Foils	Action
		E puts up church, tree, basket, Suzi and Lee on bikes
Suzi and Lee / (are going to) / the church.	are running to are walking to	E puts up phrase; S selects V
(Where) / is the basket?	Who What	E puts up sentence, S completes
It is / under the tree.		E puts up phrase;
Suzi: (What) / is in the basket?	Where Whose	E puts up balloon; S completes
Lee: (Wait.) / A baby is crying.	Wash. Clean.	E puts up balloon, S fills in
(A policeman) / and a woman are riding.	A patrol boy A woman	E adds car with policeman and woman, then puts up phrases for S to complete
The car has / (two red lights.)	two red legs. a red lamp.	E puts up phrase, S completes
(The car stopped.)	The car wait. The car go.	E removes cars with people, puts up empty car & people standing, then has S select entire sentence
Policeman: (Whose baby) / is in the basket?	Where baby Who baby	E puts up balloon, S completes
Woman: (It is) / my baby.	He are I am	E puts up balloon, S completes

RGT TEST 21 - 12D,E,F

Item	Foils	Action
		E puts up background scene & children on sidewalk
The boys and girls / (are coming to the playground.)	are riding to church. are going home.	E puts up phrase; S chooses VP
Kim and Ann / (are jumping rope.)	were jumping rope. were climbing	E puts up girls jumping rope, boys on jungle gym, then sentence; S completes it
The boys / (are climbing) / on the jungle gym.	is climbing are jumping	E puts up sentence; S selects VP
Two boys / (are climbing up.)	are climbing on. are climbing in.	E puts up subject; S selects VP
Bill / (is climbing down.)	is climbing under. is climbing to.	E puts up subject; S selects predicate
Bill: (Come) / to the sandbox	Jump Slide	E puts Bill at sandbox & part of balloon; S completes it
Jim: I / (am going home.)	are coming home. is going home.	E puts up balloon
The boys / (jumped down.)	ran down. goed down.	E takes boys off gym & puts boys "jumped down", then puts up phrase; S finishes; E puts Jim on path home
Mark: (Wait.) / I am coming.	Go. Run.	E puts up balloon; S completes

RGT TEST 22 - 13A,B,C

Item	Foils	Action
		E arranges background scene (restaurant, family, two other dining couples; puts up Tony)
Mother, Father, Kim, and Tony are in a dining room.		E puts up entire sentence
Are they home? (No.)	Yes. Eat. Wait.	E puts up question; S selects answer
(A woman is coming) / with some water.	The mother is going A boy is drinking	E puts up waitress, pitcher, prep. phrase; S completes
Mother: (Are you hungry,) / Kim?	Are your thirsty, Is them full,	E takes away waitress, after first putting up part of balloon
Kim: Yes, Mother, I want a hamburger, please.		E puts up balloon
Mother: (Do you want) / some milk?	I want You have Do want	E puts up partial balloon; S completes
Kim: No, I do not, thank you. I want some juice.		E puts up balloon, then takes away Tony
Mother: Where is Tony?		E puts up balloon
Father: He is in the bathroom / (washing his hands.)	eating some meat. drying the flowers.	E puts up partial balloon; S chooses completion
Mother: He wants a hot dog and some milk.		E puts up balloon
Father: What do you want?		E puts up balloon
Mother: I want a hamburger.		E puts up balloon
The woman is coming. / (She has) / paper and a pencil.	She have They have They has	E puts up sentence, waitress with pad and pencil, then second sentence for S to complete
Father: We want two hamburgers / (and three hot dogs, please.)	and a hot dogs, thank you. hot dogs, thank you.	E puts up balloon; S completes

RGT TEST 23 - 13D,E,F

Item	Foils	Action
		E puts baby on ground near table, Linda at table (over background scene)
It is breakfast time.		E puts up sun, low; sentence
Baby Alice is crying. She is hungry. (She wants a banana.)	She are a banana. She has an orange.	E puts up sentence S puts up entire sentence
Mother has meat and / (eggs on the stove.)	some butt on the table. cereal on the stove.	E removes old baby & puts up baby in chair; puts up phrase
Mother: Mark, / (your hands are dirty.) / Wash them before you eat.	its head is dirty. my foot is clean. our shoes are dirty.	E puts up picture of Mark, balloon; S completes
Mark: I washed them, Mother. / (I am drying them.)	I am washing them. I am drying them. I is washing them.	E puts up balloon; S selects second sentence
Linda is eating / (bread and butter) / at the table.	butter cereal a hot dog	E puts up picture of Linda eating, phrases; S completes
Mark: Mother, / (may we have) / corn for dinner, please?	we had we have whose	E puts up balloon; S finishes
Father: Linda, do you want corn?		E puts up father with balloon
Linda: No, / (I do not like it.) / May I have carrots, please?	she do not want it. it does not like it. we does not want it.	E puts up balloon; S completes
Father: We will have carrots and corn!		E puts up balloon

Item	Foils	Action
		E puts up backgro (kitchen)
(Mother cooked) / some meat and some potatoes.	Mother will cook Mother helped	E puts dirty dish silverware, mil table, and Moth Harry standing phrase
Mother: Please help me / (wash the dishes,) / Bruce and Harry.	wash the napkins, break the dishes,	E puts up balloon completes
(Harry is putting) / the glasses in the sink.	Harry is washing Harry is cooking	E puts glasses in moves Harry nea up phrase; S co
Mother: (Do not break) / the glasses, Harry.	Do not broke Please help	E puts up balloon
(One glass) / is falling.	One knives One bowl One cup and saucer	E removes glass & suspends it up sentence fo
Harry: (I broke) / the glass.	I do not break I put	E removes suspen ture of broken then balloon;
(Bruce is drying) / the plates, and / Harry is putting / (them in the cabinet.)	Bruce are washing Bruce is breaking her in the cabinet. us in the cabinet.	E puts Bruce nea towel, puts pl & has him putt then puts up a a time, for S

RGT TEST 24 - 14A,B,C,D

	Foils	Action
		E puts up background scene (kitchen)
e meat and some	Mother will cook Mother helped	E puts dirty dishes, glasses, silverware, milk carton on table, and Mother, Bruce, and Harry standing near table; then phrase
ne / (wash the d Harry.	wash the napkins, break the dishes,	E puts up balloon with phrase; S completes
the glasses in	Harry is washing Harry is cooking	E puts glasses in Harry's hand & moves Harry near sink, then puts up phrase; S completes
k) / the glasses,	Do not broke Please help	E puts up balloon; S fills in
ing.	One knives One bowl One cup and saucer	E removes glass from Harry's hand & suspends it in midair, then puts up sentence for S to complete
e glass.	I do not break I put	E removes suspended glass & puts picture of broken glass on floor, then balloon; S completes sentence
e plates, and / them in the	Bruce are washing Bruce is breaking her in the cabinet. us in the cabinet.	E puts Bruce near sink with plate & towel, puts plates in Harry's hands & has him putting them in cabinet, then puts up sentence, one part at a time, for S to finish

Item	Foils	Action
		E puts up scene, paper on sofa
Maria and Jose / (will make an airplane.)	will eat an airplane. made an airplane.	E puts up sentence; S completes
Cecilia is coming.		E puts Cecilia into scene, holding doll & blanket; then sentence
(She will watch) / them.	She will put She will make	E puts up phrase; S fills in
Cecilia has her doll and / (her blanket.)	her sheets. her pillow.	E puts up sentence, S completes; then E takes blanket from Cecilia and drapes it across TV
Cecilia: I will / (help you.)	help he. help us. help it.	E puts up balloon; S completes
Maria: (Is my paper) / in the dresser?	Are the paper Is me papers	E puts up balloon; S completes question
Cecilia: (No, the paper is not in the dresser.) / It is on the sofa.	Yes, the paper is not in the dresser. No, the paper is in the dresser.	E puts up second sentence; S supplies first sentence (in balloon form)
Maria: (May I please have) / the paper?	What does Cecilia have	E puts up balloon; S finishes question.
Maria: Thank you.		E puts paper in Cecilia's hand & lets her give it to Maria; then balloon
Maria and Jose / (made the airplane.)	are making the bed. Watched the baby.	E takes paper from Maria & puts finished airplane in Jose's hand, then sentence for S to complete
Cecilia: Watch me! I am putting my doll in the airplane.		E takes airplane from Jose & doll from Cecilia & replaces it in Cecilia's hand with picture of airplane with doll in it; then puts up entire sentence

RCT TEST 26 - 15D,E

Item	Foils	Action
		E puts up background scene & puts Ellen seated in bathtub with soap & towel
Brad: (Is Ellen) / in her bedroom?	Are Ellen Where Ellen,	's up balloon; S fills in
Mother: (No, she is not.) / She is in the bathroom.	Yes, she is. No, she is.	E puts up balloon; S fills in first sentence
Brad: (What) / is Ellen doing?	Where Whose	E puts up balloon: S completes
Mother: Ellen is taking / (a bath.)	a shower. a sink.	E puts up balloon; S fills in
Ellen has / (a towel / and some soap.)	a towel and a towel. a bird and some soap.	E puts up first part of sentence; S completes
She is washing her face / (with the soap.)	under the soap. to the soap.	E puts up sentence; S finishes
(Ellen took) / a bath.	Ellen is taking Ellen will take	E removes picture of Ellen in tub & puts Ellen standing & drying herself; then puts up sentence for S to complete
(She is clean.)	She is thirsty. She is dirty.	S puts up entire sentence

Item	Foils	Action
		E puts up backgrou and puts scarf Michael, tie in hand
Mother and Michael are in a store.		E puts up entire
Michael has on a scarf, some gloves, / (and boots.)	and a skirt. and tie. and a boots.	E puts up sentenc
(Mother is wearing) / a skirt, and blouse.	Mother will wear Mother is putting on	E puts up end of
Mother: (Please put on) / the tie, Michael.	Please take off Please put	E puts up balloon
Michael is putting on / (the tie.)	the toilet. the cap.	E takes away scar puts tie across it touches his he's putting it for S to comple
Michael does not like the tie. (picture: frowning Michael's face)	Picture: smiling Michael's face	E puts up sentenc pictures of Mic chooses appropr sticks it on Mi
(He took off) / the tie.	He is putting on He has on	E takes away extr puts up sentenc

RGT TEST 27 - 16A,B,C

	Foils	Action
		E puts up background scene (store) and puts scarf & gloves on Michael, tie in salesgirl's hand
in a store.		E puts up entire sentence.
some gloves, /	and a skirt. and tie. and a boots.	E puts up sentence; S completes it
skirt, and	Mother will wear Mother is putting on	E puts up end of sentence; S begins it
/ the tie,	Please take off Please put	E puts up balloon; S chooses verb
(the tie.)	the toilet. the cap.	E takes away scarf & gloves, then puts tie across Michael's chest so it touches his hand & neck (like he's putting it on), then sentence for S to complete
e tie. chael's face)	Picture: smiling Michael's face	E puts up sentence, then the two pictures of Michael's face; S chooses appropriate expression & sticks it on Michael's neck
	He is putting on He has on	E takes away extra face & tie, then puts up sentence for S to complete

Item	Foils	Action
		E puts up backgrou (living room)
Pat and Cathy will sleep in Karen's house.		E puts girls recli respective blank Karen in robes, slippers), then sentence
They have / (old blankets.)	new blankets. pink blankets.	E puts up sentenc
What color are Cathy's pajamas? (pink)	purple pretty	E puts up questio
Who has on a purple robe? (Pat)	Cathy Karen	E puts up questio
Karen's mother is coming.		E puts mother in puts up entire
Mother: (Please take off) / your robes, Karen and Pat.	Please have off Please put on	E puts up balloon
Pat took off her robe, and she / (is taking off her slippers.)	took off her robe. is taking off her boots.	E removes origina second Pat; the for S to comple
Cathy: Please (hang up my) robe, Karen.	hang hang up me	E removes origina standing near c then puts up ba S completes
(Karen is hanging up) / Cathy's robe.	Karen is taking off Karen is putting on	E removes robe f gives it to Ka hand, then puts to complete
Mother: I will cook / (breakfast) / on our new stove.	slippers pillows	E puts balloon u

	Foils	Action
		E puts up background scene (living room)
n Karen's		E puts girls reclining on their respective blankets (Pat & Karen in robes, all three in slippers), then puts up entire sentence
)	new blankets. pink blankets:	E puts up sentence; S completes it
amas?	purple pretty	E puts up question; S selects response
	Cathy Karen	E puts up question; S selects response
		E puts mother in living room, then puts up entire sentence
/ your	Please have off Please put on	E puts up balloon; S supplies verb
she / (is)	took off her robe. is taking off her boots.	E removes original Pat & puts in second Pat; then puts up sentence for S to complete
) robe, Karen.	hang hang up me	E removes original Karen & puts Karen standing near closet without robe. then puts up balloon above Cathy; S completes
thy's robe.	Karen is taking off Karen is putting on	E removes robe from Cathy's hand & gives it to Karen in up-reaching hand, then puts up sentence for S to complete
eakfast) / on	slippers pillows	E puts balloon up; S fills in

APPENDIX B

Expressive Generalization Tests

In the Store

The boy and the girls are in the store.

They are helping _____. [Mother / the boy / the cat]

The little _____ wants an apple. [girl / boy / man]

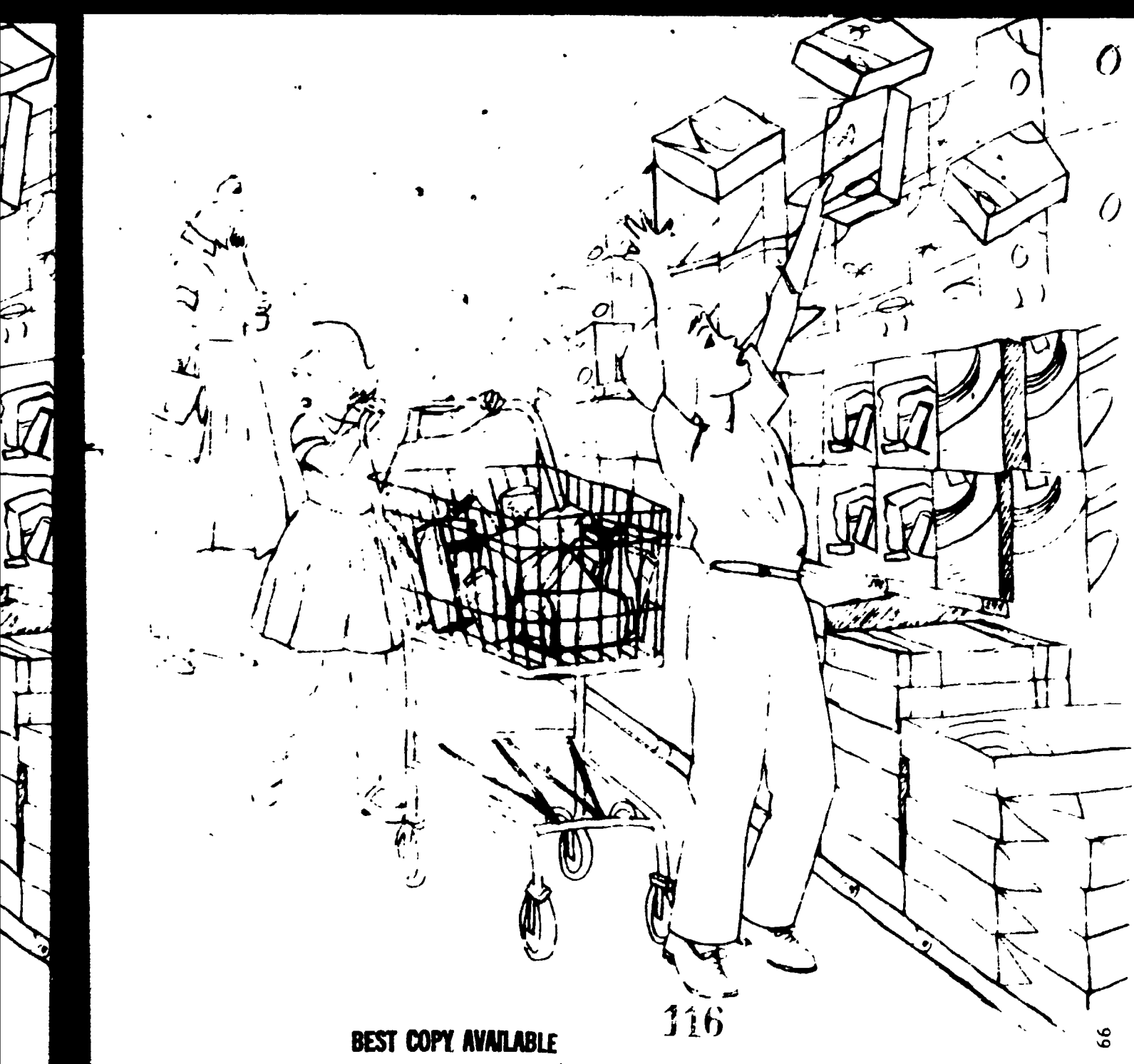
The big girl _____. [is hurt / is walking / is running]

_____ a basket. [He have / She has]

She hit _____ with the basket. [the boys / boys]

What are the boxes doing?

The boxes _____.



Father Is Dressing

Father is getting dressed.

The big girl _____

has his shoes
have shoes.
had purse

Who has the blue slipper?

_____ has the blue slipper.

What is in the closet?

_____

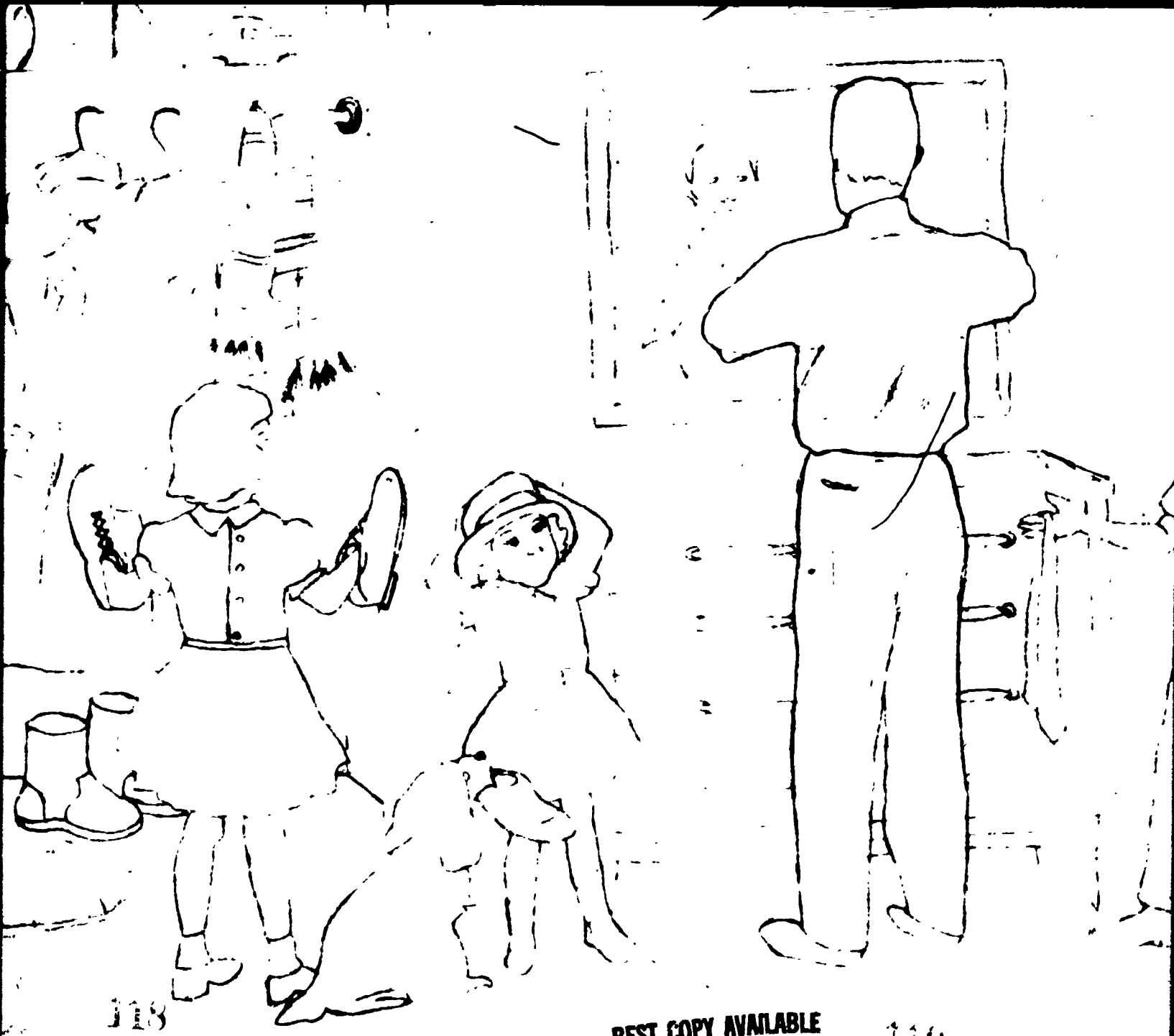
The little girl is wearing _____

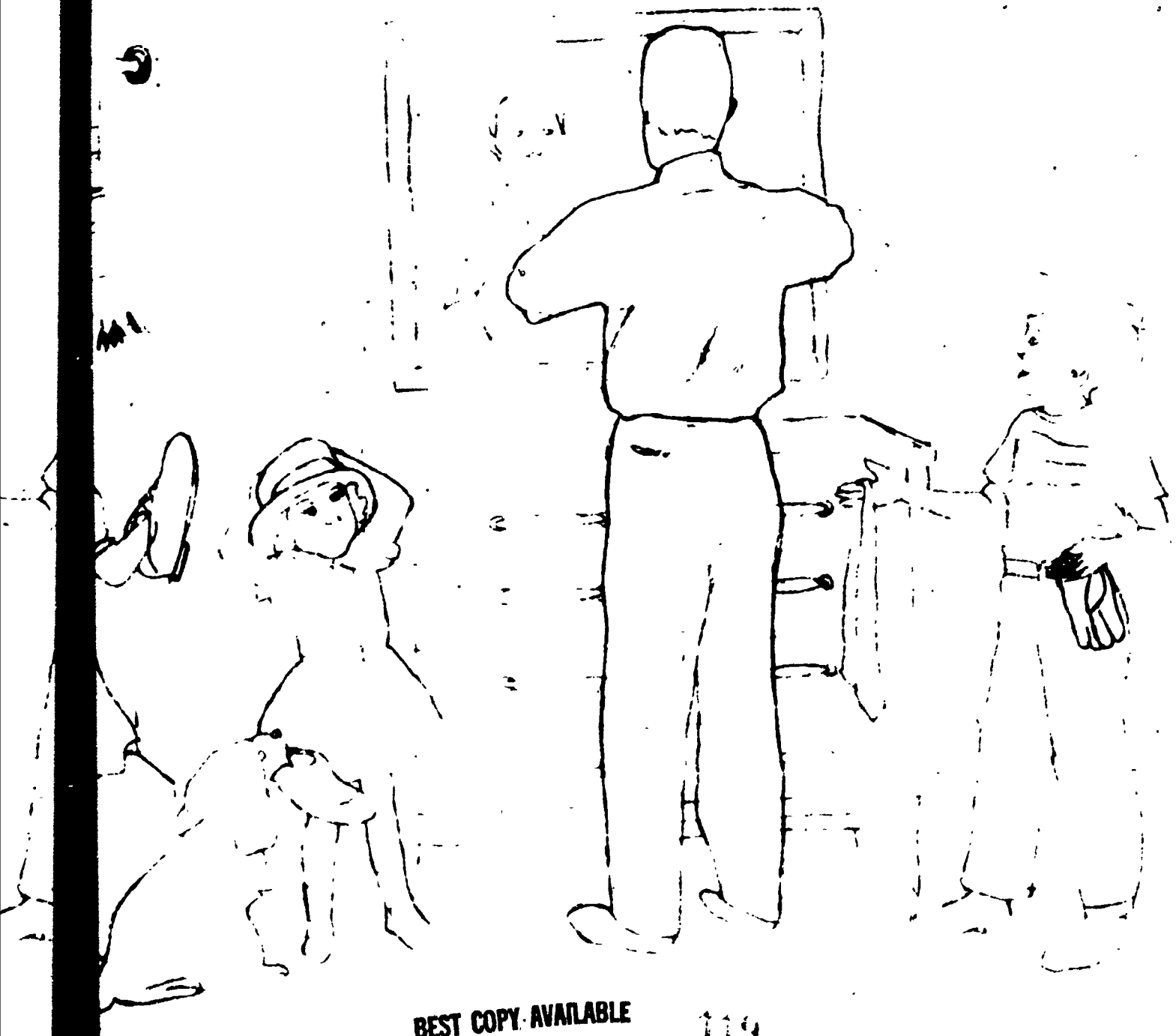
_____

What will Father wear?

_____

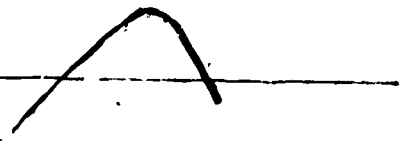
_____





At the Farm

A girl and two boys are playing on the hay.

One boy  is climbing up.
is climbing down
are climbing.

What are the girl in the red shirt and the boy in the purple shirt doing?

The girl and one boy _____.

What is the girl in the blue shirt doing?

_____.

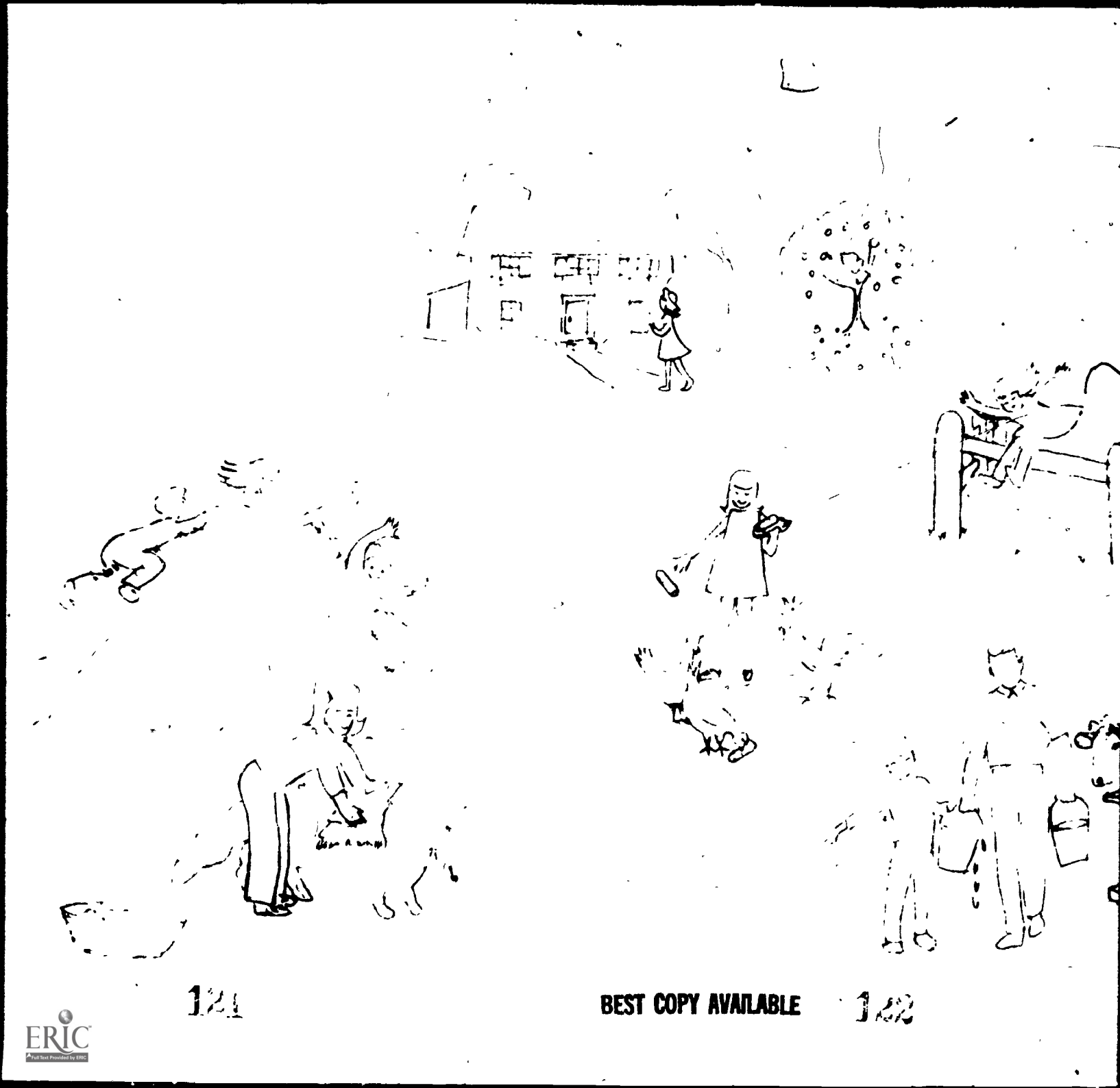
One boy _____ his father.

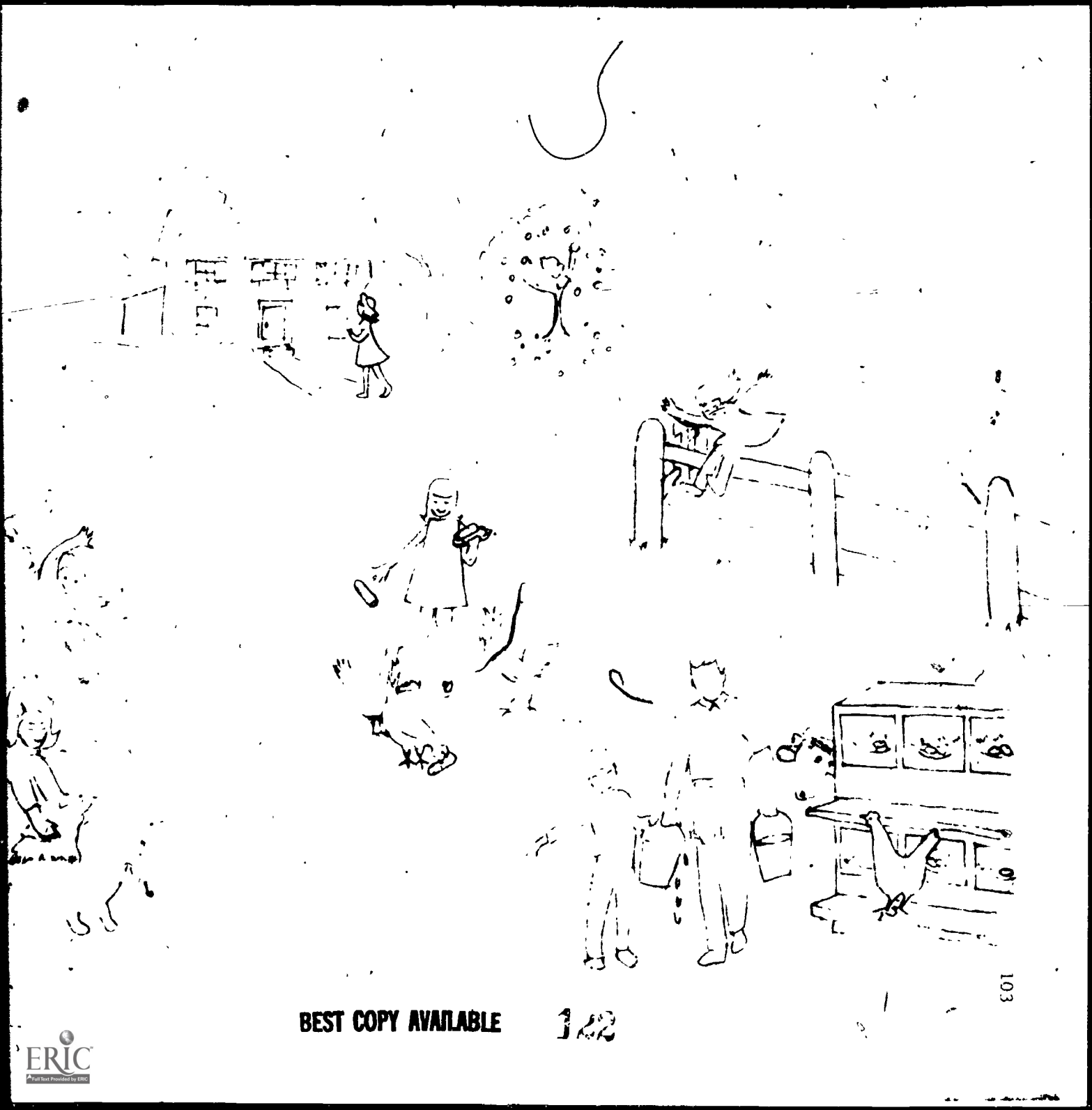
The big girl has on a yellow hat and _____

_____.

What is she doing?

_____.





Saturday Morning

The boy and girl are watching TV in the livingroom.

The baby _____ [is playing ball. / is reading a book. / is sleeping.]

Who is in the kitchen?

_____ in the kitchen.

Who is in the bedroom?

_____.

What are they doing?

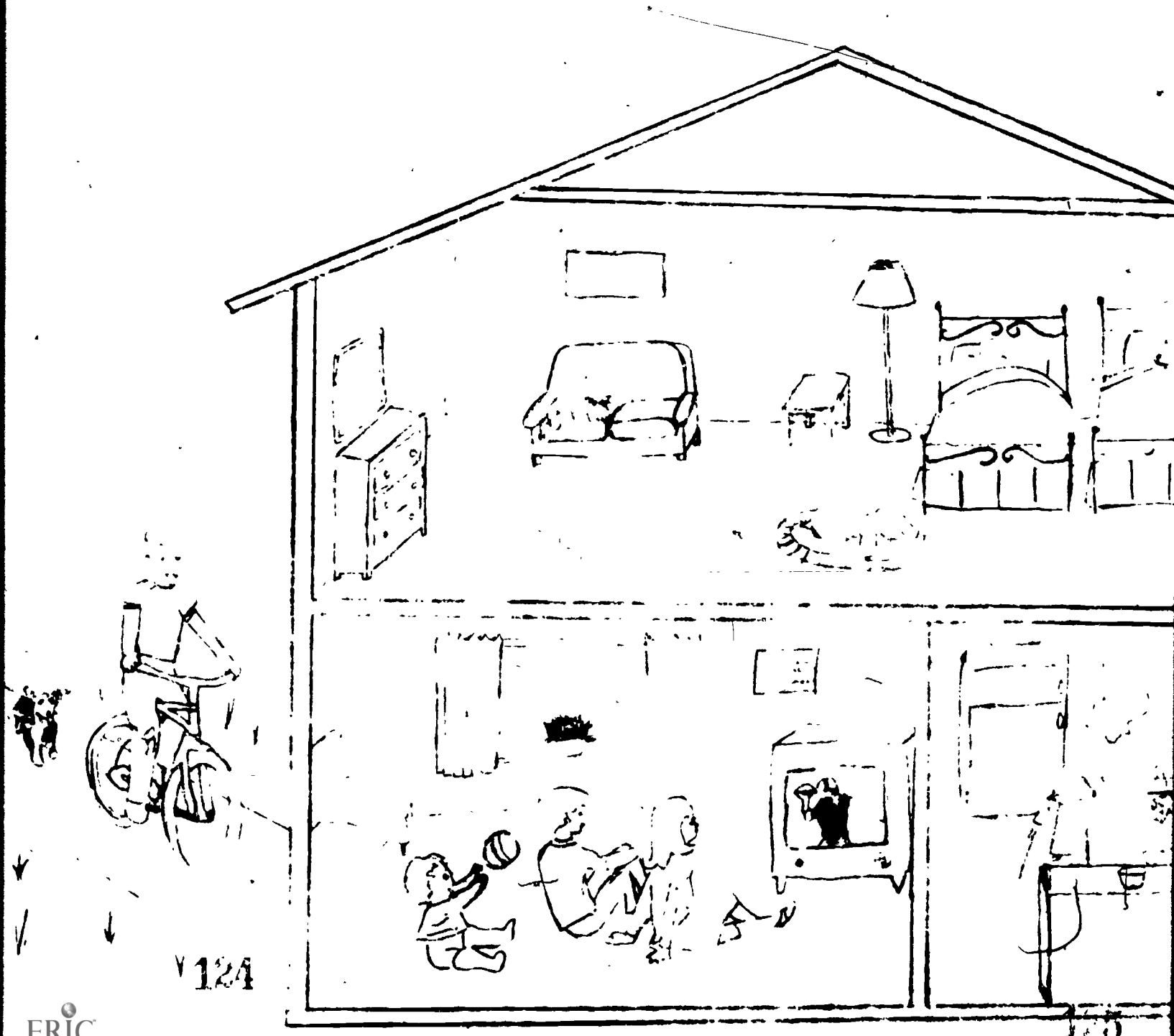
_____.

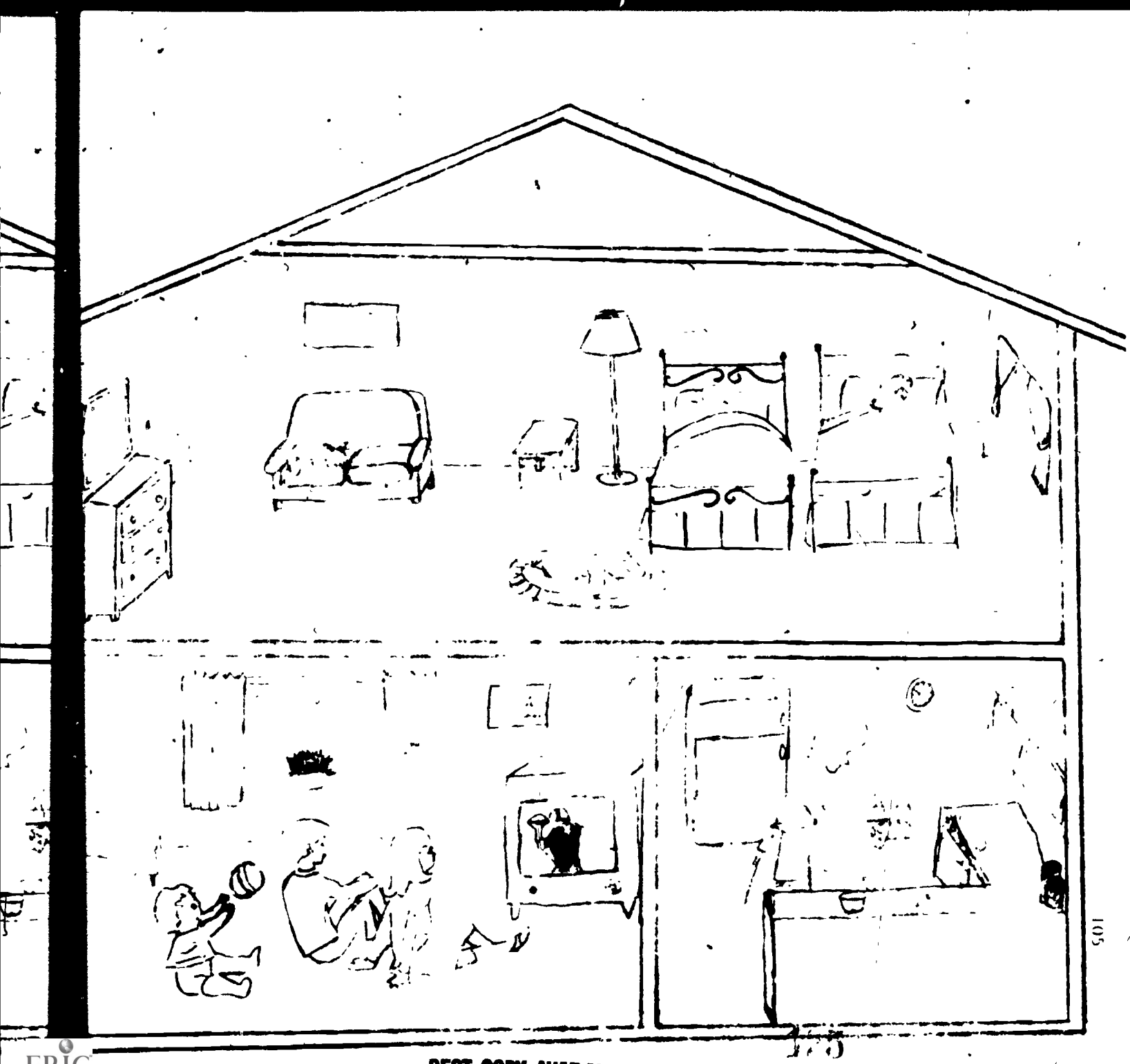
A boy is riding _____ bike.

_____ is crying.

Why is he crying?

_____.





Getting Ready for Bed

Bob, Judy, and Mother are in the bedroom.

Judy is sitting _____ [on a chair. / in bed. / on the floor.]

What does she have?

She _____ a doll.

What is Bob doing?

_____.

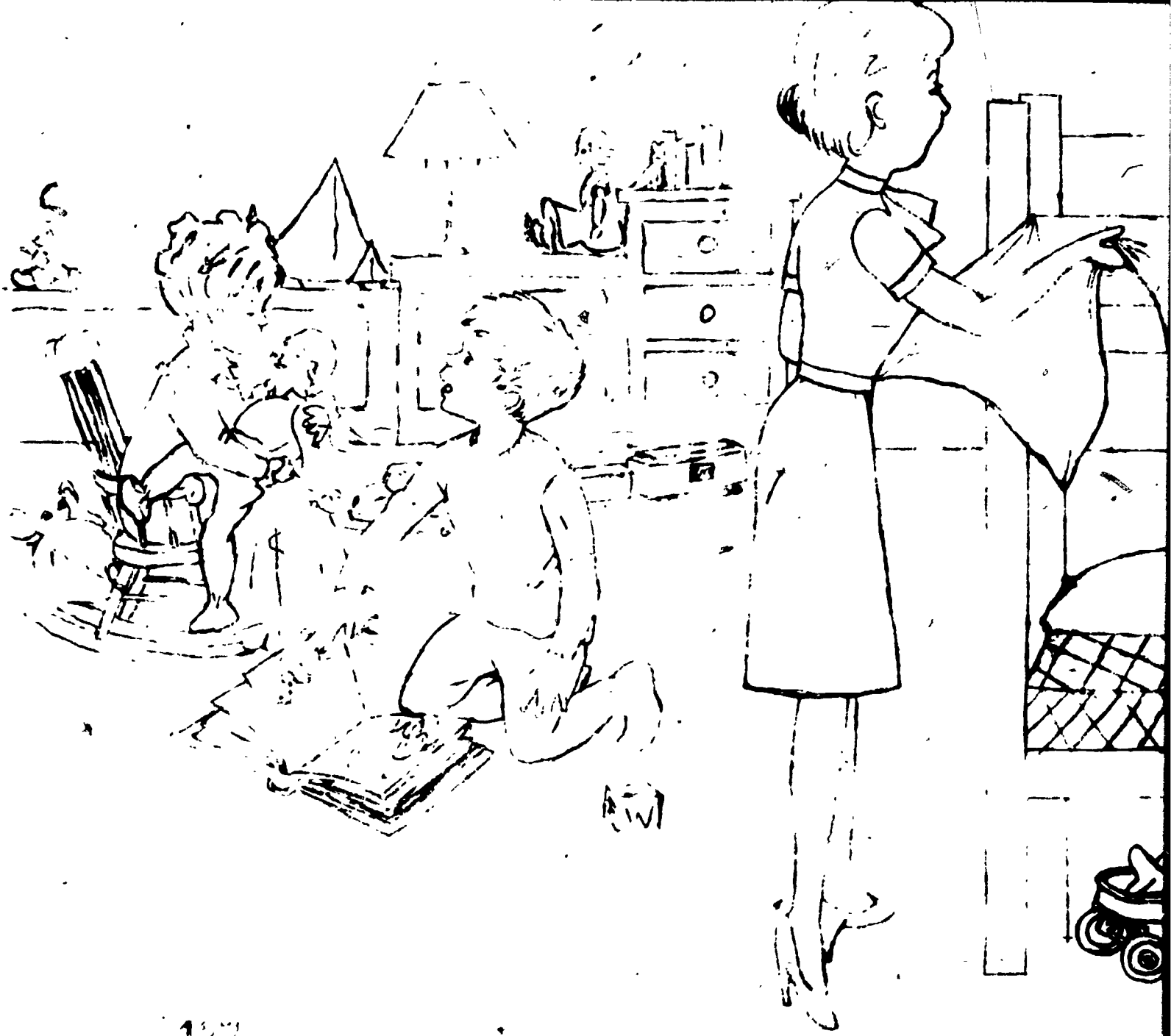
Bob and the doll _____ blue pajamas.

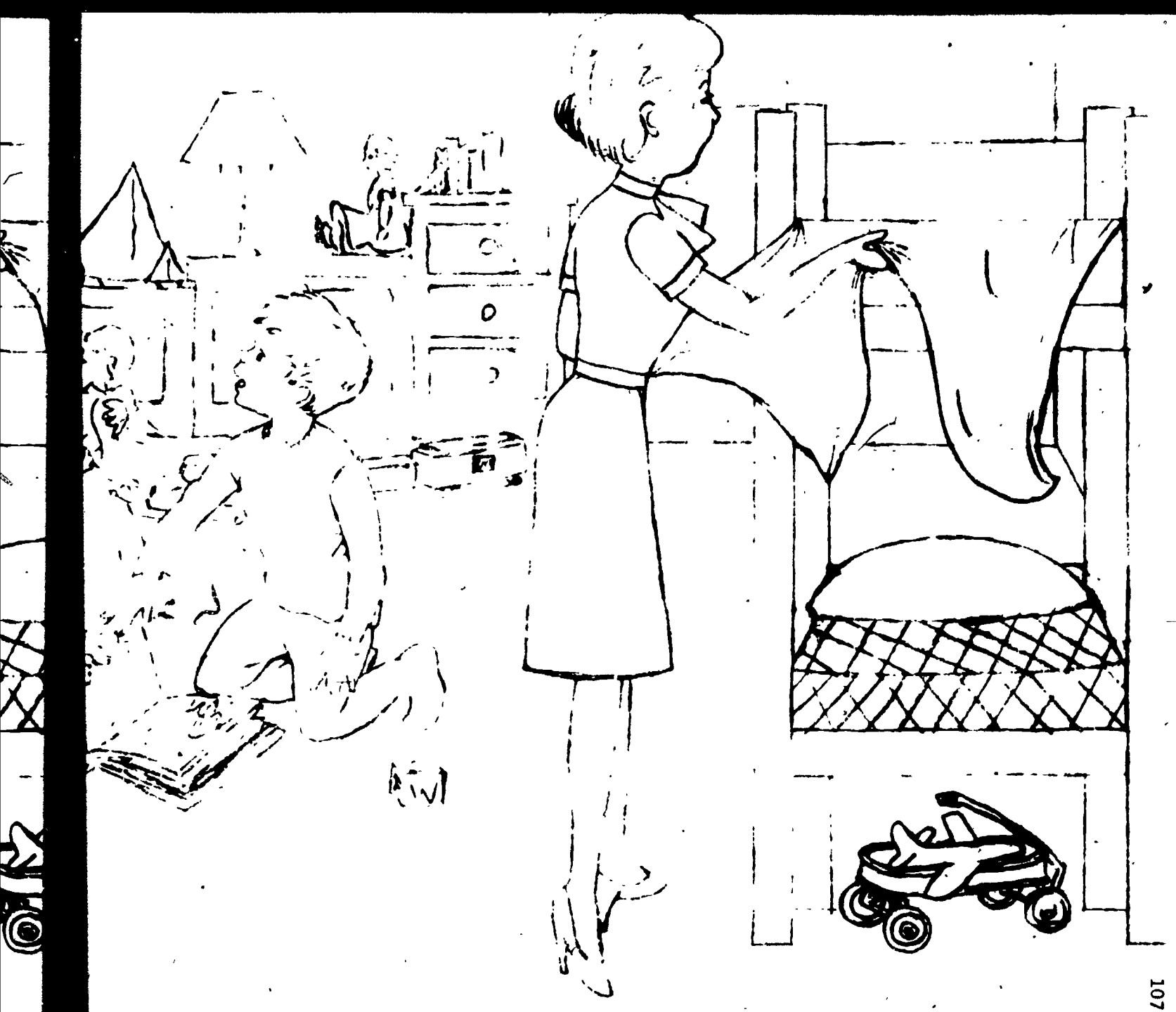
Where are the wagon and the airplane?

_____ the bed.

What is Mother doing?

_____.





At School

Some boys and girls are at school.

One boy _____ his coat.

[do not have
is putting on
will not wear]

What color is his coat? His coat is _____

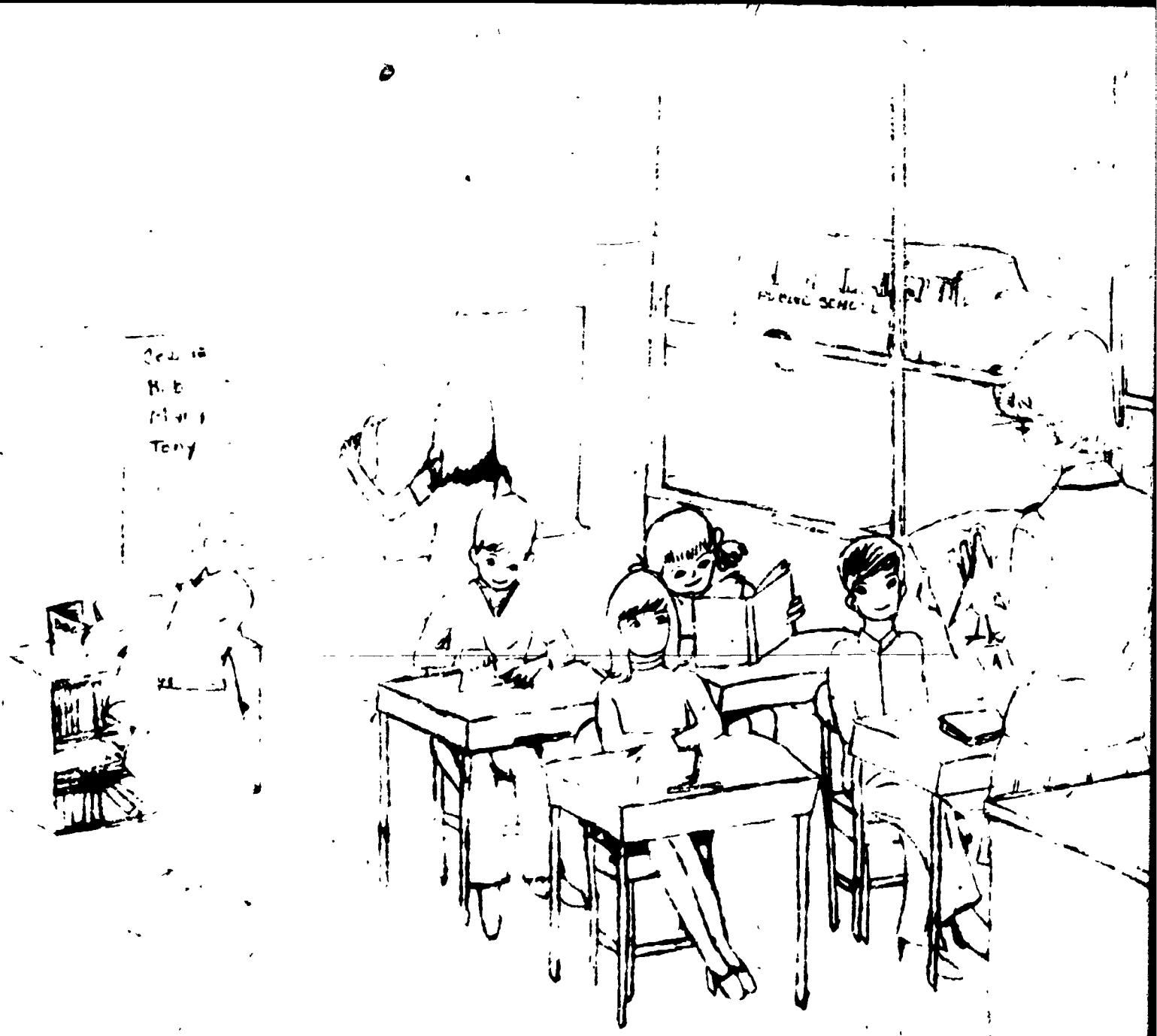
One boy has on a blue sweater. What is he doing? He _____.

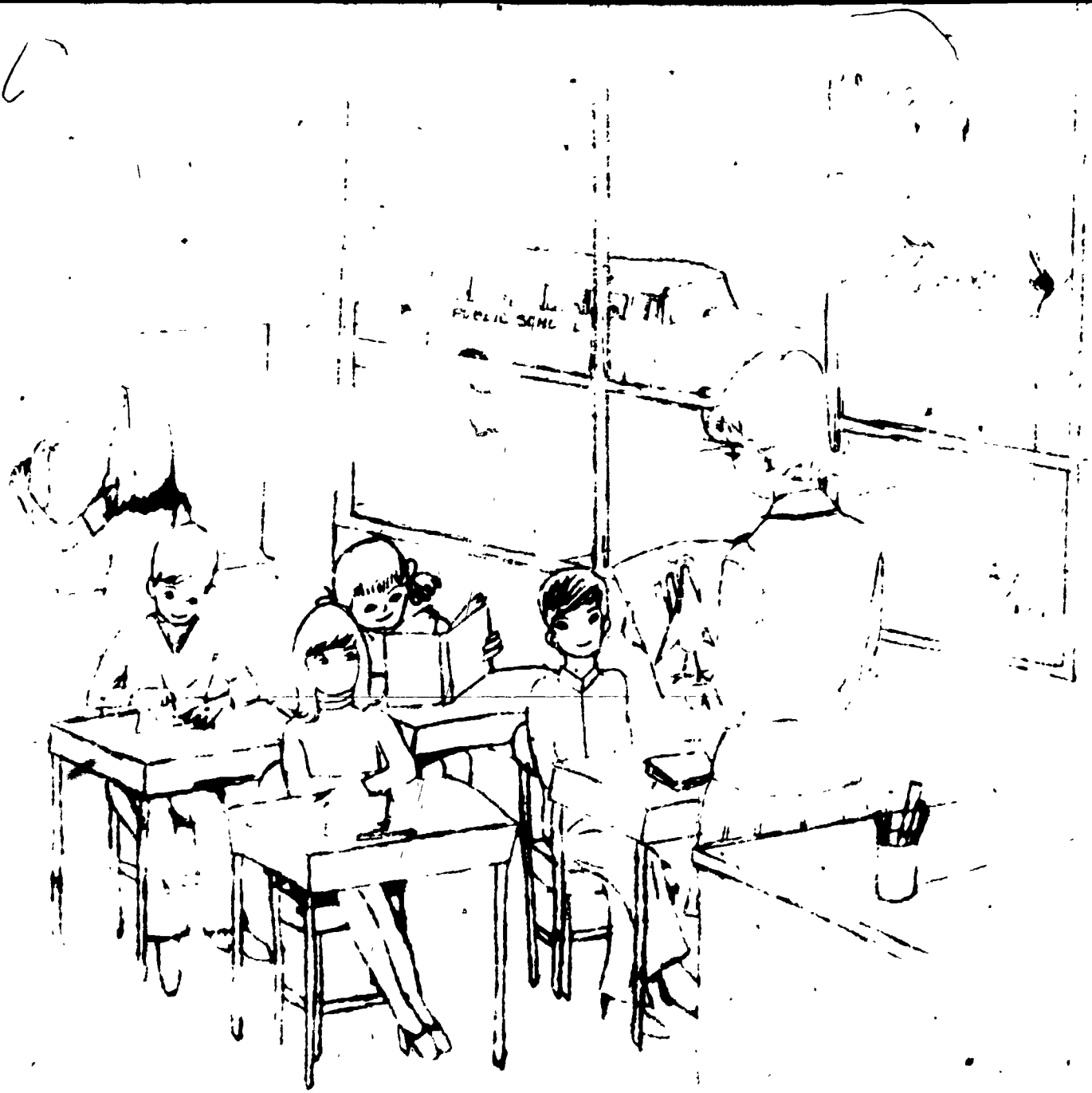
One girl has black hair. She _____ at her desk.

What does the teacher have?

_____.

What is in the street? _____





On the Playground

A little girl is sitting in the sandbox.

A little boy has _____ .

a feet
a dish
a water

Three boys are _____ on the jungle gym. They have _____ balloons

A girl _____ sitting on a swing. A boy is pushing _____ .

The boy in the chair _____ the ball. The boy with the yellow shirt _____